Pests
AND THEIR CONTROL
1944
JULY
VOL. 12 NO. 7
ORGAN OF THE PEST CONTROL INDUSTRY
Exterminators
Fumigators
Termite Control Operators
Entomologists
Insecticide and Supply Mfgrs.

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Pests

and Their CONTROL

Exterminators, Fumigators, Termite Control Operators, Entomologists, Insecticide and Supply Manufacturers

COOPERATING WITH NATIONAL PEST CONTROL ASSOCIATION

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EDITORIAL

DDT and Structural Pest Control

NEWS REPORTS of the almost miracle-like results obtained with DDT, which, for the last year or more, have flooded not only the public but the professional and trade press, have made absorbing reading. For reasons of military security, however, and possibly other causes too, the information released has been, for the most part, generally vague, oft-times contradictory and rarely, if ever, scientific as to form or text.

Of welcome interest, therefore, at this time are the reports* published in the February issue of the Journal of Economic Entomology, of a series of tests conducted by the Bureau of Entomology and Plant Quarantine to appraise the usefulness of DDT as an insecticide for both agricultural and structural pests. To be sure, most of the reports are already dated and much more has been done since they were written, nevertheless, they represent much more than an inkling of what may be in store, as do the story on DDT and the scientific data concerning its compositions, published elsewhere in this issue.

So much for the situation to date. What of the future? Will DDT prove to be the revolutionary factor in structural pest control that some have predicted for it? The answer is, of course, that we don't know—and won't until the results of the Cooperative Research Project field tests, now under way on a nation-wide basis, are tallied, studied and evaluated. Undertaken to find out if DDT can be used successfully in controlling household pests, the project is a joint effort between the Bureau of Entomology and Plant Quarantine and the National Pest Control Association—the first time, incidentally, the Bureau has ever taken such a step. At the conclusion of the Project, it is expected a report of its findings will be submitted to the entire industry by the Association, through whose efforts the tests were inaugurated.

Meanwhile, it should be noted, there is still no DDT available for commercial use.

*Several are reprinted in this issue; others will appear in a subsequent one, there being about ten, all told, relating to structural pests. In the interim, reprints may be obtained at twenty-five cents each or five for one dollar by communicating with Ernest N. Cory, business manager of the Journal of Economic Entomology at College Park, Md.—Ed.

Municipal Rat Control

FROM THAT APOSTLE of rugged individualism and free, or private, enterprise, the Washington, D. C., Times-Herald, comes this editorial somersault. Worried about the growing menace of the rat to health, it urges in part that "the government for the District should hire some more professional rat killers right away (the Health Department now has a staff of only six such to cover this huge city) and let them teach the public how to wipe out this dangerous pest of rats in the speediest possible fashion." Vigorous exception must be taken to this editorial, not alone for itself but because it typifies a growing propaganda urging municipalities to invade the precincts of private enterprise, in this instance—rat control.

It would be unfortunate, to say the least, if this line of thought were to take practical root. For, in the long run, efficient rat control can be achieved best, we think, only if each municipality fundamentally acts as an investigatory and survey agency, with findings followed by ordinances compelling property owners to remedy rat infestations. Pest control firms can be called in, of course, when the property owner feels he cannot do the job himself. With particular reference to Washington, D. C., however, there is need for better enforcement of the sanitary and rat-proofing laws now on the statute books.

Charles F. Cook

Charles Frederick Cook, 76, whose sons, Roland and Kenneth, are associate owners with George Elliott of the Ransford Insecticide Co., of Worcester, Mass., died on June 4. Born in Ellsworth, Me., Mr. Cook was a former collector of customers for the Port of Worcester, retiring six years ago after forty years in the U. S. Custom Service.

Mr. Cook was a member of several fraternal orders, including the Masons and Odd Fellows, and was a past patriarch of Mt. Vernon Encampment.

Surviving are his three sons, Bernard P., Roland M. and Kenneth N. Cook; a daughter, Mrs. Ralph F. Field; 14 grandchildren and two great-grandchildren, all of Worcester.

Hollis M. Bartlett of the Lake View Congregational Church, Worcester, officiated at the services.

Our deepest sympathy to the members of the Cook family in their loss.

A Correction

In an article by H. E. Gray on "How Stored Product Insects Damage Food, Fur, Fabric and Wood" appearing in the June issue there was a typographical error under the spider beetle illustration on page 14—the name of the insect is ptinus raptor and not "raptar" and the word "Huttes" in both cases should have been beetles.

Notice

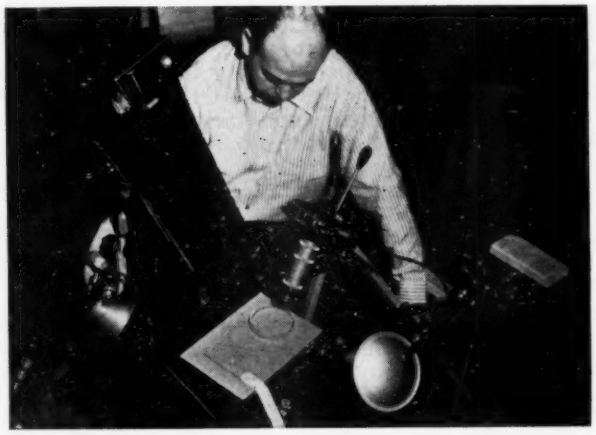
We are glad to print personal items of interest. Send us interesting or newsy items about yourself or your family. This magazine is for the pest control industry, and news about YOU is interesting to the rest of us.

Scenes Prefacing "Life" Story on "Household Pests"

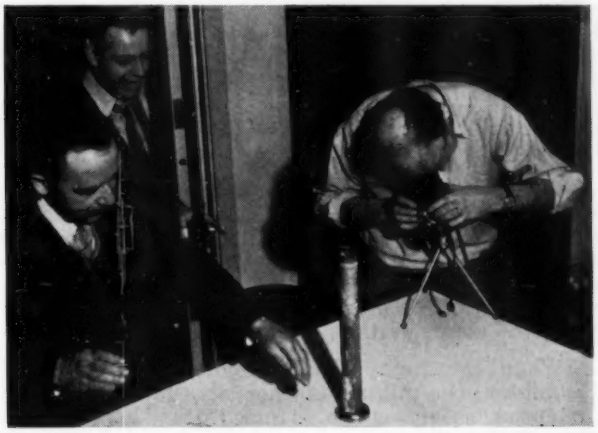
NOT GENERALLY realized, we think, is the extraordinary amount of painstaking effort that went into preparation of the story in the March 6 issue of "Life", which, among other things, re-emphasized the growing scientific outlook of the structural pest control profession.

Of informative interest, therefore, are some first-hand facts and photos made available through the courtesy of Walter S. McCloud, a former NPCA president. Mr. McCloud worked in close cooperation with Fritz Goro and Don Morris, Life's cameraman and writer, respectively, assigned to the story, and Doctor Gould, of Purdue, before and during the time the pictures were taken at the Purdue Conference.

Cameraman Goro had what it 'takes' for his assignment: patience, imagination and a high degree of photographic skill. Some 500 shots were filmed by him, with at least an equal number of flashlight bulbs used up in the process. In fact, he stayed on for several days after the close of the conference taking additional shots.



(1) Here Goro has maneuvered his camera and its complicated gadgets into position for some excellent shots of a 'blessed' roach event. Prior to this he had spent considerable time locating an egg capsule most likely to 'succeed' in the shortest possible time. Notwithstanding several hours elapsed before Mother Nature delivered, Goro, meanwhile, pacing the floor with a father-like expectancy.



(2) Shows how roaches gain access into homes. At the lens: Goro, while Galen Oderkirk (left foreground), of the U. S. Fish & Wildlife Service, and Don Morris, look on with amused as well as professional interest.

(3) Prof. J. J. Davis and Dr. George Gould are shown teaching a class of PCOs the basic entomological structure of insects.

THE MOUSE

By WILL CUPPY

You may not care much for Mice, but you can't ignore them. There are more Mice in the world than any other mammal.[1] Wherever you are, there is a Mouse not far away. He may be closer than you think. Mice of all kinds are extremely prolific. Mother Mice have babies all the year round, from four to thirteen at a time. They don't know when to stop. Young Mice grow up very quickly. They leave the nest and start something when they are only a few weeks old, and it is always the same old story. So I guess Mice will go on forever. The House Mouse is found in all civilized places and in some others I might mention. Mouseologists say House Mice are not native American Mice because they were introduced from abroad, but who wasn't? House Mice settled at Jamestown in 1607 and more came on the Mayflower in 1620. Unless he arrived on the last boat, any Mouse chosen at random has more ancestors born in this country than any Mouseologist of my acquaintance, so why be stuffy about it? The Field Mouse and the Whitefooted Mouse were here even before 1492, and you don't hear them heckling us on the subject, either. House Mice are loyal little creatures. They will stay with you to the last crumb. They sample everything in the pantry, and you can hardly blame them.[2] Mice believe chocolate layer cakes grow wild for the general good. They think life is like that. It should be. Once in a while, a Mouse will sneak into the living room to watch you at your strange antics, and you may decide to let him stick around, he looks so friendly and intelligent.[3] You think it will be great fun to have a Mouse of your own. Besides, it will give the Mouse a real home and a sense of security.[4] Some evening you may notice that he isn't the same Mouse and that another one seems to be streaking across the floor just for the heck of it. A check-up will probably reveal that you now have fourteen Mice, most of them expecting—which was not your original idea at all. Moral: It is practically impossible to have one Mouse.

[1] We have plenty of Rats too.
[2] In the anicent Sanskrit language, the Mouse was called Mush, from a verb meaning "to steal." Oh yes? And how did they come to have such a verb?
[3] Most House Mice trained in a laboratory can find their way out of a trick box or maze, if you give them enough trials. I could do that myself.
[4] Tossing bits of cheese to Mice is a mistaken kindness. Cheese is bad for Mice.

—*Saturday Evening Post, April,* 1944.

DDT

"NOW IT CAN BE TOLD"

The remarkable story of DDT, as released by the Geigy Company, Inc. t its press meeting at the Hotel Pennsylvania, N. Y. on May 31, follows. References to agricultural pests appearing in the original have been, for the most part, eliminated. Material headed "DDT Research and Our Pest Control Industry", subjoined to the story, is a reprint from NPCA Service Letter No. 330, and is of pertinent interest.—Ed.*

A CHEMICAL FORMULA which lay dormant for almost seventy years in a dusty volume of "Berichte der Chemischen Gesellschaft" (the Reports of the German Chemical Society) has suddenly come to life as the progenitor of a spectacular series of insecticidal compositions that seem destined to achieve in preventine medicine an effectiveness already likened to that of penicillin and sulfa drugs in the curative field.

Apart from their sensational preventine properties, dramatically demonstrated in the Army's virtual conquest of typhus, the compositions, in results already attained and in hopes induced by current tests, encourage the belief that they will bring about an economic revolution in the field of agriculture by crops saved from the scourge of insect pests.

When the Geigy patent application was filed in Washington, the military authorities, having come upon a potential major weapon, clamped down a firm secrecy order which had prevented, until last summer, the revelation of any phase of the amazing developments involved. Now, Geigy Company, Inc., New York, is able to disclose some of the major aspects of a remarkable discovery made by that Geigy's parent organization in Switzerland. It was the Geigy organization that discovered the amazing possibilities of these compositions and obtained patents in various countries including Switzerland, England, Canada, and the United States (U. S. Patent No. 2,329,-074) and persisted so firmly in its efforts to induce the Government's interest that science now is able to claim another great boon to mankind. Recent official announcements of the universal effectivenss of one DDT composition (Neocid**) in eradicating typhus in Italy and elsewhere have brought this marvel of chemistry to public notice.

Military secrecy still envelops certain important phases of the product's effectiveness. However, sufficient information now may be imparted publicly to bare some of the huge benefits recorded and to indicate others in the saving of lives and in the momentous economic savings in agriculture.

DDT compositions used by the Army are required by the military and naval forces in such tremendous quantities that for the time being none is available for civilian use.

DDT, popular symbol for dichloro-diphenyl trichloroethane, now the active ingredient for these amazing compositions, was synthesized in 1874 by a young German chemistry student, one Othmar Zeidler, in Strasbourg. His formula was a routine accomplishment in connection with a thesis he was preparing. He regarded it merely as a casual test tube evolution of no particular significance and recorded it in a brief six lines of notations in the Proceedings of the German Chemical Society. Zeidler had no idea of the insecticidal values inherent in the formula and his name, like the formula, has remained until now in obscurity.

It was several years ago that, in the testing of a number of formulae, Paul Muller, scientist of J. R. Geigy, of Basle, Switzerland, synthesized the product and discovered its amazing insecticidal properties. In 1939 the potato crop of Switzerland was seriously threatened by the imported (from America) Colorado Potato Beetle. Geigy made available to the Swiss entomologist, Dr. R. Wiesmann, a composition carrying the designation "Experiment No. G1750" which was later called "Gesarol***". Dr. Wiesmann conducted experiments in the Swiss Federal Experimental Agricultural Station at Waederswil and confirmed Geigy's results which culminated in the control of the destructive Potato Beetle. Shortages of the accepted insecticides, arsenates, pyrethrum and rotenone further encouraged the investigations which have revealed DDT compositions as the outstanding development in the insecticide field for many years.

When the United States entered the War it became manifest that its uniformed men would be sent to all parts of the world, meeting the menace of typhus and other dread diseases in many infected areas. Geigy in Basle, aware it had the most effective enemy of typhus ever experienced in medical history, informed Major De Jonge, American Military Attache in Berne, in August, 1942, that Neocid, the lousicidal composition of DDT, had proved amazingly effective against the typhus carrying louse, and that it possessed incredible residual potency, an all important factor.

Geigy simultaneously notified its New York subsidiary of its significant discovery. Contrary to a false published story that a quantity was smuggled out of Switzerland, it was sent openly from Basle, as a regular transaction between the two divisions of the chemical firm. Another false story, that Geigy was unaware of the lousicidal properties of the composition, is refuted by the fact that Geigy not only discovered its lousicidal properties but brought them to the attention of the U. S. Government in 1942.

From the materials submitted by Geigy to the U. S. Department of Agriculture, much excitement was created. Geigy, New York, then imported 100 Kilos of the active ingredient, DDT, the greater part of which was donated to the Department of Agriculture. Thereafter, scores upon scores of the Bureau's experts undertook experiments in experimental stations all over the United States.

The experiments confirmed Geigy's claims and proved so spectacular as to attract the attention of Colonel William S. Stone of the Surgeon General's Office and the Office of Scientific Research and Development. Colonel Stone's direction in this work was a great spur in bringing this lousicide from the research stage to adoption by the armed forces. He is in the field in Italy today. The Office of Scientific Research and Development had appropriated funds for this field of research to enable the Bureau of Entomology to go ahead. Dr. F. C. Bishopp, Assistant Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, Charge of Research, United States Department of Agri-

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BUY WAR BONDS AND STAMPS...FOR VICTORY

culture and Dr. Walter E. Dove, Chief, Division of Insects Affecting Man & Animals of the Bureau of Entomology & Plant Quarantine ably directed activities. At the Orlando, Fla. testing station alone a staff of 29 scientists under the supervision of Mr. E. F. Knipling were assigned to investigate further possibilities of DDT compositions in combatting pests affecting the armed forces. Scientists throughout the country were enlisted in this "all out" effort to check on the startling results obtained and to determine the full extent of the efficacy of the DDT compositions against pests affecting the military. Too much credit cannot be given the Orlando station for the amazing developments of military uses for DDT compositions. The 29 scientists worked unheard of hours which resulted in having this weapon ready for the Italian campaign. Many of our servicemen and many Italian citizens owe their lives to the tireless efforts of those 29 men and their directors.

Entomological investigation continues at a maddening pace and it is safe to say that scientific data which under normal conditions would take all of eight years of effort to compile will be available in two years. Few will ever know what sacrifices scientists throughout this country have made of their time and effort to have DDT compositions ready for the armed forces and the public.

Walls and ceilings covered with a Gesarol spray remain deadly to flies for three months. Dairy cattle made nervous by flies have been quieted by sprayings of the compound, an important item when it is realized that a cow's milk productivity is lowered by a pestilence of flies—apart from sanitary considerations. Beef cattle similarly are benefitted.

The results thus observed on farms point to preventine possibilities against diseases transmitted by flies to human beings. Thus diarrhea and dysentery which plague armies in the field will be ameliorated by the destruction of the disease-carrying fly. Statistics are not available on the effectiveness of this control method at present but interesting data should be obtained in the near future. In civilian life many cases of typhoid are caused by flies. Here again, destruction of flies and reduction of cases must be considered companion incidents.

Structural Pests

Tests on dogs and cats have shown that Neocid not only eradicates fleas but also affords subsequent protection for a long time. In ordinary domestic use, the composition has been most efficacious against moths, roaches, bedbugs, silverfish. Beds properly sprayed just once with a DDT composition continue to be 100% effective even after 300 days against the bed-bug, the bane of some hospitals and institutions.

House owners may also be comforted by assurance of its deadliness to termites. In this case it is a palliative rather than a preventine control.

Like the natural products, Pyrethrum, Rotenone and Nicotine, commonly used as insecticides, DDT compositions are poisonous on contact by common insects, paralying an insect's nervous system and giving it what has been alliteratively called the "Gesarol Jitters".

Both a Stomach and Contact Poison

To insects Gesarol is both a stomach and contact poison, a unique characteristic, indeed. So far as entomologists are concerned, this is a sensational circumstance. Claims by Geigy, Switzerland, of this double quality, seemed fantastic and were received with some skepticism by American scientists. Their reluctance may be appreciated when it is stated that of 3,000 synthetic organic insecticides tested by the Department of Agriculture only two were found to possess both contact and stomach lethal qualities, Sodium Fluoride and DDT. Geigy, well known in the synthetic dyestuff field but relatively new in the insecticidal field, had hit the scientific "jackpot". From an economic standpoint, the savings may be understood when it is known that in the same area it has been necessary heretofore to use two poisons, stomach and contact, to combat the two types of pests. With few exceptions Gesarol takes care of both.

Fumigation and egg destruction, which are other general methods of insect control, are not as convenient and direct in action as the spraying and dusting with DDT compositions. Incidentally, DDT compositions have no ovicidal value (do not kill eggs), but the effect of these compositions is so lasting that the insect is killed as it is hatched.

Not a Cure-All

Meanwhile, it is not claimed for Gesarol and Neocid*** that they are cure-alls. They are not. They are specific. They cannot be said to replace in **every way** any one of the presently employed insecticides, nor are present DDT compositions eminently effective against all insects as is evident by the poor results so far indicated against the Mexican Bean Beetle, the Red Spider, the Cotton Boll Weevil and only fair results on some others.

Toxicity to Man and Animals

The toxicity of Gesarol and Neocid preparations to man and animals is still under investigation by the U. S. Public Health Service, the Food and Drug Administration and the Kettering Laboratory of Applied Physiology of the University of Cincinnati, the last mentioned research being sponsored by Geigy. Research goes on. Indeed, considerable research is still necessary to determine all the possible uses and ineptitudes of DDT compositions. The forms and methods of application, the rates of application and the dosages on specific plants and in specific climates must be settled. Research is proceeding as rapidly as good practice permits.

Enough has been revealed to indicate the possibility of wide application in agriculture, households and in preventive measures against disease-carrying insects to establish the DDT compositions as among the great scientific discoveries of our time.

DEFINITIONS OF PRODUCT NAMES

*DDT—A contraction established by Governmental Agencies for Dichlorodiphenyltrichloroethane, the active ingredient or so-called pure product. It must be diluted with a carrier such as oil or talc to be usable. DDT is synonymous with GNB-A, which is the contraction for Gesarol Neocid Base—"A" indicating "Made in America".

**Neocid—A generic term, by Geigy, of a series of insecticidal compositions for use against insects affecting man and animal.

***Gesarol—A generic term, by Geigy, of a series of insecticidal compositions for use against agricultural pests.

NEOCID

A Generic Term, By Geigy, of a Series of Insecticidal Compositions of DDT for Use Against Insects Affecting Man and Animal.

THE GEIGY NEOCID is available in powder form, in solution or emulsion or as a dry spray concentrate, (which may be diluted with water), the form used depending upon local conditions and the insect to be treated.

The use of compositions against these insects are today most important and the results have been little short of miraculous. It is unnecessary to repeat what has already been said about the

A few months more . . .

will make a tremendous difference to the Pest Control Operators in the manner of handling and applying ***Neocid** (compositions made from ***GNB-A—DDT).**

The delay, in making the products available for civilian use, which follows the great demands of the armed forces is being used profitably in research, and is sure to result to the advantage of producers and consumers.

In the meanwhile production forges ahead rapidly to bring us closer to meeting the demands projected by the armed forces for which this amazing discovery by Geigy has resulted in a major weapon.

Geigy urges patience until these military needs are met.

Remember 10 lbs. of GNB-A—DDT (100 lbs. Neocid) protect 800 soldiers for one month against the dread typhus.

Note:—Insecticidal compositions containing GNB-A—DDT as active ingredient are covered by U. S. Patent 2,329,074.

****Registered U. S. Patent Office***

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New York (8)
New York

Geigy

In Great Britain
The Geigy Colour Co., Ltd.
National Buildings
Parsonage, Manchester

effect of Neocid against body lice. Let us merely state that this product has probably saved the lives of many thousands of our boys, as well as many civilians.

The dry powder has been used successfully against **head lice** and **fleas.**

The liquid (solution in Kerosene) Neocid has been found extremely effective against **bedbugs,** by spraying mattresses and beds. One application of a 5% spray is reported still 100% effective after 300 days.

The housewife is frequently bothered with **ants** and **cockroaches.** These pests have been controlled successfully with Neocid preparations. This includes the large **American roach** as well as the small **German roach.** Neocid powder dusted into cracks and on shelves will retain its efficiency for months. A 2% dust applied to the ground has been found very effective against **chiggers.** This is good news for some of the Southern States where these pests are a constant annoyance to man.

The most spectacular results of all, however, have been obtained with **flies.** These insects are provided with very delicate nerve receptors on the tips of their legs. By merely walking over a deposit of Neocid, which may be invisible to the naked eye, they will be permanently affected, and although they do not die instantly, they are doomed. There is no escape. This single contact with the residue seems enough for their destruction.

The Swiss were the first to make this practical observation, and, as early as 1942 they reported that walls and ceilings of stables which had been sprayed with a Neocid composition containing as litle as 0.05% DDT remained free of **flies** for over one month. **Free of flies**—this is exactly what they stated two years ago, but skeptics soon had to admit that they were right. If the concentration of the dry sprays is increased, (which, of course, leaves a visible deposit on the surface in the case of dry sprays), the period of efficiency has been known to have been extended for as long as three months. Farmers are naturally anxious to get this product which with **one** or **two** applications causes barns to remain virtually free of fly infestation for the entire season.

Cattle were treated in Texas with DDT compositions and satisfactory control of the **horn fly** (which is a major cattle pest in the South) was reported.

The household sprays of the future will probably contain a percentage of DDT because the addition of this product considerably improves the present fly sprays. DDT will hardly be used alone in these sprays because it lacks the dramatic knockdown of Pyrethrum or the Thiocyanates, however, it makes up for that deficiency with positive and lasting "kill".

These few sketchy remarks on the Gesarol and Neocid preparations are none-the-less encouraging and convincing. Of course, the vaster the field, the more work for the entomologist. Government and private laboratories are working feverishly on research of these remarkable insecticides. Probably the best equipped entomological stations in the world are in the United States as well as the best-trained personnel to use these facilities. There is wonderful cooperation between the Government and Industry which gives us the assurance that post-war America will lead in the fight on insects.

DDT Research and Our Pest Control Industry

AGRICULTURE has managed to be supplied with a small quantity for research. The Service Trades Division of the of Civilian Requirements of the War Production Board has appealed for a small quantity which might be utilized for field tests by pest control establishments. Even such a program will lead to difficulties of distribution in that there is so little available for such experiments.

The National Pest Control Association took up with the Bureau of Entomology and Plant Quarantine the worthwhileness of a cooperative project and that based entirely on the premise that as much time as possible should be saved in determining the effectiveness of DDT as, if and when DDT would be made available for commercial use. There has accordingly been worked out a cooperative research project. The NPCA Research Projects Committee of which J. Edwin Sameth (1060 Broad Street, Newark 2, N. J.) is Chairman has with the approval of the Bureau of Entomology chosen a group of PCO "co-operators", strategically located in all sections of the country which at the same time calls for observations and detail progress reports being kept jointly by personnel of the Bureau of Entomology and Plant Quarantine and the NPCA Research Projects Committee.

The PCO "co-operators" have given their assurances of complete assistance. Detailed instructions have been given; carefully prepared report forms have been devised; DDT will be used in either or both powder and liquid form, depending upon the assignments that have been made. Ultimate release of information is to be determined by the Bureau of Entomology and Plant Quarantine after careful review of findings are studied and in any event the entire pest control industry is to benefit by the research conducted. In short, no individual advantages are to accrue to any firm or any DDT made available for commercial use until there are any supplies not required by the Armed Forces. This cooperative research project might well become a forerunner of similar activities so that the pest control industry will benefit much more rapidly because of "known facts" as to effectiveness and all that makes for a proper understanding of the chemical and technique of application.

From the standpoint of the PCO:—Rigid practical (field) tests should make it passible to state with assurance

(a) That DDT is or is not superior to any of the usual materials and methods of control now practiced.

(b) That the residual effect of DDT is or is not an effective and potent weapon for use by our industry.

(c) That the residual quality of DDT can or cannot be utilized by our industry to better serve the public.

As stated previously, all preliminary procedures have been carefully planned for the cooperative research project. It is the only method that could assure DDT being released and we are indeed gratified that the Bureau of Entomology and Plant Quarantine is giving assistance and guidance in that we benefit by experiences to date.

Initial efforts and work will be with bedbugs, roaches, carpet beetles, dog ticks, fleas and silverfish. The choice of these common insects should be obvious.

PCO Quiz—No. 5

MULTIPLE CHOICE QUESTIONS. You are to check the correct answer. Score yourselves 4 points for each correct answer. Consider yourself above average if you score 80, and average if you score 64. Check the correct answer.

26. The term "black cyanide" is applied to (1).....sodium cyanide, (2).....liquid cyanide, (3).....calcium cyanide.
27. Fumigants and many contact poisons act on insects mainly by penetration of the (1).....stomach wall, (2).....respiratory system, (3).....nasal membranes.
28. Potassium antimonyl tartrate is used extensively for (1) .....roach control, (2).....fumigant for clothes moth, (3) .....ant baits.
29. The most important factor in the toxicity of sodium fluoride to cockroaches is the (1).....roaches' habit of cleaning its antennae, (2).....penetration by the chemical of the unsclerotized portion of the sternum, (3).....swallowing of the poison.
30. Thallium compounds should be used only by trained operators because of (1).....explosive properties, (2).....gases emitted, (3).....no warning taste or smell.
31. Sodium fluoaluminate (cryolite) when used as a dust for roach control shows (1).....high toxicity, (2).....moderate toxicity, (3).....little or no toxicity.
32. The highest grade of pyrethrum powder is obtained from (1).....the open flowers, (2).....closed flowers, (3).....the flower buds.
33. The toxic ingredients in Derris root in addition to rotenone include (1).....sabadilla, (2).....deguelin, (3).....strychnine.
34. In general the arsenites are more toxic to insects than the arsenates because of their (1).....greater solubility, (2)..... color, (3).....purity.
35. Paradichlorobenzene is a (1).....fumigant, (2).....contact, (3).....stomach poison.
36. Sodium fluoride usually kills roaches as a (1).....stomach poison, (2).....contact insecticide, (3).....fumigant.
37. Bedbugs can live without food for (1).....10, (2).....50, (3).....300, (4).....1000 days.
38. Typhus fever is carried by (1).....flies, (2).....mosquitoes, (3).....lice, (4).....ntites.
39. Bedbugs have (1).....two, (2).....three, (3).....four different stages in development.
40. Cockroaches have habits which are (1).....nocturnal, (2)..... diurnal.

(Continued on Page 28)

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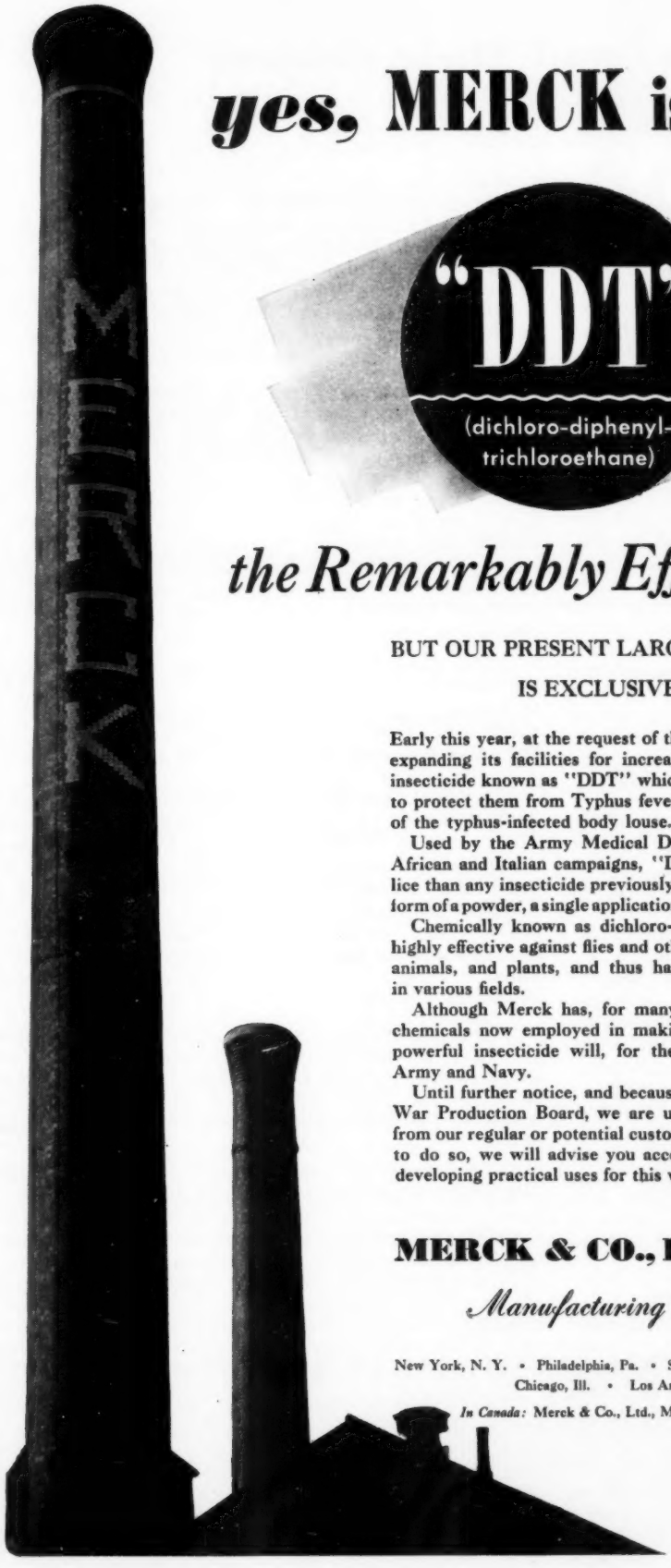

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Chemically known as dichloro-diphenyl-trichloroethane, "DDT" also is highly effective against flies and other insects which are a menace to humans, animals, and plants, and thus has numerous possibilities for postwar use in various fields.

Although Merck has, for many years, been producing one of the basic chemicals now employed in making "DDT," our total production of this powerful insecticide will, for the present, be devoted exclusively to the Army and Navy.

Until further notice, and because our entire supplies are controlled by the War Production Board, we are unable to accept direct orders for "DDT" from our regular or potential customers. However, when we are in a position to do so, we will advise you accordingly and gladly cooperate with you in developing practical uses for this very promising product.

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Cockroaches and Their Control*

By C. GRAHAM MacNAY, *Division of Entomology, Ottawa, Ontario*

Introduction

SINCE THE COCKROACH is one of the few insects about which a song has been written, the subject might well have been introduced by the singing of "La Cucaracha". Perhaps in the not too distant future the Pest Control Operators will have a song sheet including "La Cucaracha", "I Know Where the Flies Go" and other songs that tie in with the profession.

The cockroach, related to grasshoppers, crickets, katydids and mantids is the modern representative of one of the oldest orders of insects, and is so well adapted for survival that it has undergone comparatively little evolutionary change over a very long period. During the middle ages when the most unpleasant substances were considered the best remedies for disease, roaches were used as medicine. They were taken internally, raw, roasted, boiled and in various solvents. There is an old Spanish proverb "The cockroach is always wrong when arguing with a chicken", but, since we now know that the roach is an intermediate host of the proventricular worm of chickens, it looks as if the joke may be on the chicken after all. Roaches do not normally occur in very cold latitudes, but their numbers gradually increase toward the tropics where they are very abundant. Imms in 1934 stated that there were about 1,200 known species. Only a few of these, however, are found in Canada.

This paper is the result of a review of some of the more recent literature on cockroaches and their control. In the main, the data is based upon laboratory research carried out chiefly by investigators in the United States, and should be of value to the pest control operator.

Economic Importance

The cockroach is of economic importance on account of its close association with humans. It is a scavenger but its foraging habits and unpleasant odour are objectionable and it is commonly associated with uncleanliness. It is a spoiler of food, a likely carrier of pathogenic bacteria, and an intermediate host for certain worms infesting poultry and other birds. It commonly frequents houses, apartments, restaurants, stores, warehouses, bakeries, slaughter houses and packing plants, public institutions such as jails, libraries, etc.; in fact, any place affording warmth, food, moisture and convenient hiding places. Heavily populated areas are the most likely to be heavily infested, partly due to our system of handling food supplies and waste.

Canadian Species and Their Life Cycles

By far the most common species occurring in Canada is the German cockroach (**Blattella germanica** L.). Both sexes have well-developed wings and, in colour, are light brown with two distinct dark-brown longitudinal stripes on the thorax. Nymphs are dark brown and have no wings. Adults are about one-half inch, or a little over, in length.

The egg capsule begins to form within a week or two after mating, and when completed may contain, on an average, two to three dozen eggs. If the capsule is dropped prematurely by the female before it separates naturally, the eggs will die. Several capsules may be deposited by a female during her life. The eggs hatch in from two to five weeks, depending on temperature and other environmental conditions, and nymphs mature in from six weeks at 80°F. to six months under less ideal conditions. Adults may live, under suitable conditions, anywhere from about three to ten months, and may survive as long as six weeks without food.

The oriental cockroach, or black beetle (**Blatta orientalis** L.), is not a common pest in Canada but has been recorded from points in British Columbia, Saskatchewan, Ontario and Quebec, and likely has appeared in other provinces. It may grow to about an inch in length. The wings of the male cover about two-thirds of the abdomen and those of the female are only short stumps. The male is dark brown and the female black. The female buries her egg case in earth or sand; the eggs hatch in two to three months and the nymphs require from eight to eighteen months to develop. Oriental roaches die at a maximum temperature of 97°-104°F.

The American cockroach (**Periplaneta americana** L.), the largest of the roaches, also is not common but is occasionally found in goods brought into Canada, and there are records of infestations in Ontario. It thrives best at a temperature of about 80°F. Males may attain a length of 1½" and females are slightly larger. Wings of the female are about the same length as the abdomen while those of the male extend slightly beyond its tip. The colour is brown, the thorax having pale margins. A female has been known to produce as many as 90 egg capsules (average 60) each containing about 16 eggs. Eggs hatch in about two months and nymphs mature in from eight to eighteen months. Total development may require three to four years in cooler climates. They are killed in a few minutes by a minimum temperature of 15° to 20°F.

The Australian cockroach (**Periplaneta australasiae** Fab.), is occasionally found in imported goods such as bananas, but is not a pest in this country. It resembles the American roach with the exception that the thorax and front margins of the wings have a conspicuous yellow band.

The woodland or Pennsylvania wood cockroach (**Parcoblatta pennsylvanica** DeG.) is quite prevalent outdoors in rocky, wooded areas in Canada, especially in Ontario and Quebec. It frequently infests summer cottages and occasionally becomes a pest in dwellings. The male resembles the American roach in size and colour, and has fully developed wings. The wings of the female are quite short. This species overwinters as a nymph and its life cycle requires about 12 months. Adults live about five months.

The brown-banded roach (**Supella supellectilium** Serv.) is marked by two yellowish-brown cross bands 1/16" apart just posterior to the base of the wings. The body of the male is yellowish-buff and the female somewhat darker. This species has been moving steadily northward through the United States since its discovery in Florida in 1917, and was found in infestation form in a house in Montreal, P.Q. in 1940 (4). It competes

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with the German roach in the United States and may possibly become a pest of economic importance in Canada.

Habits and Sources of Infestation

Roaches avoid bright light but may be seen commonly at twilight when they come out of their hiding places to feed. They eat many kinds of food such as potatoes, vegetables, fruits, syrup, honey, bread, flour, sugar, cheese, breakfast foods, meat, also clothing, leather, paper, live and dead insects, even their own egg-cases, cast skins, old or sick roaches and those that have difficulty in moulting.

Roaches, in general, thrive best at temperatures of 70° to 80°F., and at least two species, the German and the oriental roaches, die in a few hours at temperatures of 23°F. or less and 108°F. or over.

Household infestations commonly originate from insects brought into the home in packages, grocery orders and the like. Egg capsules may be brought in in the same way. Roaches, having flat bodies and being active travellers, are able to spread from one place to another through quite small cracks and openings. Those having well developed wings may fly into buildings.

Effects of Insecticides on Roaches

An insecticide may act as a stomach poison or it may kill by contact.

A stomach poison may be eaten along with food material or it may be ingested in the process of cleaning the antennae and legs, a habit common to all roaches. In fact they are quite meticulous, carefully drawing each antenna and leg through the mouthparts and swallowing the particles. It has been a general belief that sodium fluoride acts as a stomach poison, but many investigators claim that most roaches find sodium fluoride sufficiently unpalatable to prevent their ingesting a lethal dose (6). Other workers (10), (17), give results of tests with the American roach which indicate that sodium fluoride kills by contact.

Pyrethrum in solution in oil or dispersed in water is said to act as a stomach poison, but it does not act in this manner when used in powder form (3). Actually such effects, if any, would be secondary to the contact action of pyrethrum and of lesser consequence.

A contact insecticide may enter an insect's body through the integument by absorption, or it may be taken into the respiratory system. In order to reach the integument it must first pass through an oily film which covers the roach's body and, due to the fatty nature of this material, some insecticides are better able to penetrate to the body than others (16). Once through the protective oil film, an insecticide must penetrate the integument which varies a great deal in thickness. Sodium fluoride placed close to the legs is much more effective than when placed on the posterior part of the abdomen (11). Hydrated lime with sodium fluoride assists in the penetration of the oil film but is claimed to be impractical as it carbonates in the dust (5).

Both sodium fluoride and pyrethrum act as contact insecticides, penetrating the film and integument, and, when mixed together, are much more effective than when either is used alone (17). The pyrethrum stimulates activity and tends to force roaches out of their hiding places; when they become partially paralyzed they drag their bodies through the insecticide thereby collecting a lethal dose (12).

Particles of insecticidal dusts or liquids which enter the respiratory system via the breathing pores are very effective as the breathing tubes divide and subdivide passing ultimately to all parts of the body. Their walls are very thin and the insecticide is quickly absorbed into the body tissues.

Pyrethrum sprays are said to cause female roaches to drop their egg pods prematurely and many fail to hatch due to dessication (15). Female roaches are more resistant to insecticides and temperature extremes than are males, and roaches generally are more resistant to insecticides than most other household insects.

Methods of Prevention and Control

(a) **Preventive Measures:** Pest Control Operators, possibly in some instances, may not be greatly interested in this phase of control, but there are such things as contracts, and there is always the chance that one's own home may become infested.

If possible, keep roaches out of the home by vigilance and care. Orders made up at a store should be taken home immediately and a watch should always be kept for egg pods or roaches when opening packages. Deprive the insects of food material by scrupulous cleanliness in the home, and careful disposal of waste food and other garbage. Deprive them also of hiding places by refitting loose woodwork and filling cracks. Tightly fitting screens on all windows, doors, etc. are a help, particularly where the woodland roach is plentiful.

In heavily populated areas, it may be almost impossible to avoid continual re-infestation, but such measures as those already mentioned, will definitely keep the roach population at a minimum.

(b) **Roach Powders:** Powders are more effective in roach control than other materials. They can be dusted in out-of-the-way places and left there to work for long periods of time while a spray has relatively only an immediate contact effect. Roaches are active travellers, and, even if the dust does not reach the insects when applied, they will eventually get into it, and receive a lethal dose. It is much simpler to have the insect come to the insecticide than to take the insecticide to the insect as one must do in the case of spray materials.

A 25-75% mixture of pyrethrum and sodium fluoride is considered one of the fastest and most efficient roach killers, due in part to the fact that they are synergistic, being much more effective together than when either one is used alone (14). Recent tests (8) at Purdue University have shown a 100% mortality to result in four days with a mixture of 20% pyrethrum (0.1% pyrethrins), 10% sodium fluoride and 70% pyrophyllite. This would seem to indicate that the 25-75% mixture is much stronger than is necessary for good results. Sodium fluoride with pyrophyllite in a 25-75% mixture, in four days produced 100% mortality in males and 96% in females. Sodium fluosilicate in small particle size (4 to 10 microns) is also an effective killer, slightly slower in action than sodium fluoride but equal in eventual kill. It should be used at a somewhat greater strength than the latter. When mixed 50:50 with pyrophyllite, a fine grade of sodium fluosilicate has been found to give good results in tests against the German roach. As sodium fluosilicate is irritating to the nasal passages, dusts containing substantial quantities of this material might be "loaded" with a small quantity of light oil. This has been found effective with pyrethrum and sodium fluoride, in causing the mixture to settle out of the air more rapidly (9).

Borax and boric acid are both effective. Though not generally rated very high, it is claimed that borax is equal to most roach powders at the end of a week and superior at the end of two weeks (6).

Dust chamber tests (8) comparing borax and boric acid produced the following results: a 50-25-25 mixture of boric acid, sodium fluoride and pyrophyllite resulted in 100% mortality of male roaches and 82% of females in four days. A mixture of the same proportion using borax in place of boric acid resulted in a mortality of 96% of males and 50% of females in four days.

These results indicate boric acid to be more effective than borax, and, since they both work slowly, it is possible that a higher mortality would have resulted over a longer period. In the same series of experiments, 2,4-dinitroanisole at a strength of 10% with pyrophyllite produced a mortality of 100% in male roaches and 90% in females in four days, indicating a superiority over sodium fluoride.

Experiments at the University of Tennessee (5) resulted in better control with 50:50 and 10:90 mixtures of sodium fluoride and borax than from the use of either one alone. Sodium fluosilicate alone and a boric acid-pyrophyllite mixture were not found to be particularly effective.

Summarizing the roach powders: mixtures of sodium fluoride and pyrethrum head the list in effectiveness, but are possibly equalled by 2,4-dinitroanisole (8). Finely-ground sodium fluosilicate may be used as a substitute for sodium fluoride but must be applied at a somewhat greater strength.

Finely-powdered boric acid and borax are effective but somewhat slow, boric acid being superior to borax. A mixture containing 50% boric acid (impalpable grade), 20% pyrethrum powder and 30% pyrophyllite is recommended (8) for use where sodium fluoride or sodium fluosilicate cannot be used. Good results have also been obtained with mixtures of 10 to 20% pyrethrum and 80 to 90% boric acid (2).

The quality of all ingredients, both active and inactive, of roach powders cannot be stressed too greatly. They should be of very fine grade so that they will more readily adhere to the insect or penetrate the spiracles or integument. Many good materials have been discredited in the past as a result of using grades having too large particle size. When materials of very fine grade are used in roach powders, the addition of a small quantity of light oil will reduce excessive dispersal (9).

(c) **Liquid Insecticides:** As already stated, sprays are not as effective as powders. They affect only the insects that are hit, and it is difficult to reach them in their hiding places, at least with the type of sprayer used by the average householder. Sprays, however, can be effectively used with good equipment, and, under conditions of very high humidity it is advisable to use them, as powders may "cake up" fairly rapidly. Such conditions frequently exist in such places as parts of dairy buildings and in basements.

Most Grade AA sprays are effective against roaches if the insects receive a reasonable dose or coverage. They are much more resistant to pyrethrum sprays than are flies, however, and require several times the dosage to produce death.

A new control material called 4,6-dinitro-ortho-cresol has been reported by Gahan (7) to be more effective at a 5% strength than pyrethrum at 5% or sodium fluoride at 50%. It, however, is toxic to animals and has a tendency to stain.

Aerosols, due to their properties of penetration, may prove of value against roaches. The pyrethrum aerosol bomb has been reported to be effective in driving out roaches but tests in the United States in 1942 did not result in effective control (1). Little data is available as yet, and aerosol bombs are even less available.

(d) **Crayons:** In experiments carried out at Ohio State University (13), wet sodium fluoride molded and dried in the form of crayons was used to mark surfaces like chalk. Such marks or lines applied on infested surfaces were reported to be effective against German cockroaches. Practical applications in an infested restaurant kitchen, a grocery store and an apartment were said to be effective, safe, convenient and economical.

If further tests bear out these results, sodium fluoride crayons may prove a valuable addition to the Pest Control Operator's assortment of weapons of attack. They should be considerably safer than the powder form in kitchens and in homes where children and pets are to be considered.

(e) **Traps:** Traps can be used to reduce a cockroach population and to hold it at a low level, but are not likely to clean up an infestation. A simple, convenient trap may be made by soldering a wire screen cone in the metal ring of an ordinary fruit jar. This can be removed and replaced readily, so that removal of roaches and rebaiting the trap is a simple matter. Wire screen cones are better than paper or other solid material as they permit the odour of the bait to escape more freely, thereby increasing the catch. Sliced banana. potato or fermenting fruit are effective baits. The traps should be placed in roach runways.

(f) **Fumigants:** While it may be possible to clear up a cockroach infestation by fumigation, this method is generally considered to be less effective than the thorough use of suitable dusts.

(g) **Phosphorus:** Pastes containing from 1 to 3 per cent of phosphorus are said to be effective in cleaning up moderate infest-

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ations of the larger species of roaches, but are comparatively ineffective against the German roach (6). The American and Oriental roaches are strongly attracted to phosphorus paste and are readily controlled by it (9).

Inert Carriers

As already indicated, the nature and quality of the materials used have a great bearing on the effectiveness of insecticidal dusts. This applies to the inert carriers or diluents as well as to the active ingredients. Research at Purdue University (9) indicates that the diluent should be as fluffy and as finely ground as the active ingredients which it carries. Pyrophyllite is rated very high as a carrier, it being cheap as well as effective. Diatomaceous earth is said to be too fluffy and certain clays and gypsum to be too heavy. Certain starches, dextrines and flour are so fine that they adhere together to form a lumpy mixture that blows unevenly from a duster. The clays and bentonite have the undesirable property of combining with and holding the active ingredients. Pyrophyllite, starch and acid type dextrine are said to be excellent diluments when finely ground.

Spent pyrethrum or pyrethrum marc when used alone, and even when fortified with certain extracts, gave poor results in tests against roaches (9). It should, however, have value as a diluent or carrier in roach powders.

Application of Control Materials

(a) **Equipment:** Only by using the best equipment available, keeping it in good order, and suiting the implement to the task can the best results be obtained. One cannot do a two-horse job with one-horse equipment. Large sprayers with plenty of pressure and adjustable nozzles give better atomization and can be adjusted quickly to the need, whether it be a fine mist or a more solid spray to penetrate cracks, etc. Dusting equipment, too, should be adequate, with plenty of capacity and pressure and provided with changeable attachments for varying requirements.

(b) **Technique:** Success or failure in insect control depends largely on the manner in which control materials are used. Good material may be wasted and poor results obtained through careless application. A dust lightly but thoroughly applied will give better control than a heavy application poorly distributed. Cracks and crevices in woodwork, spaces behind cupboards and filing cabinets, radiators, switch boxes and the like should be given attention. Cabinet drawers should be removed and dust placed behind and beneath them. The most important places to apply a dust are those obscure corners, often overlooked, in which it may be left undisturbed for extended periods of time rather than have it swept up within a day or so. Sprays, too, should be just as thoroughly applied and the nozzle adjusted to the particular need of the moment.

If varying conditions of humidity are encountered in a control area, such as a dairy building, dusts should be used where possible, and sprays substituted where conditions of moisture and humidity cause the dusts to cake up too rapidly. In damp basements, heavy paper may be spread on the floor, an attractive bait placed in the center, and roach powder sprinkled on the paper in a ring formation around the bait. Traps, when used, should be placed in roach runways, rather than just in any convenient place.

Replacement Materials

On the basis of the data herein reviewed, mixtures of sodium fluoride and pyrethrum powder hold first place in roach control, followed closely by 2,4-dinitroanisole. Lacking the more effective materials, a fluffy, finely-ground sodium fluosilicate is suggested as a substitute for sodium fluoride but it must be used in slightly greater strength. Fineness of particle size is stressed and a 50:50 mixture with pyrophyllite is suggested as an effective roach powder under normal conditions. Nothing so far can quite take the place of pyrethrum in mixtures with the fluorine compounds, and any pyrethrum that may become available should be extended by keeping the concentration low. Where poisonous dusts cannot be used, a mixture containing 50% boric acid of finest grade, 20% pyrethrum powder and 30% pyrophyllite is suggested. Boric acid and borax, as substitute materials, are effective but slow in action, a fine grade of the former being superior to the latter. Phenothiazine shows some promise of being an effective contact insecticide for roaches but there seems to be some doubt as to its practical value. The material 4,6-dinitro-ortho-cresol has possibilities but is limited by undesirable qualities as already noted.

Conclusion

In general, and particularly while shortages persist, the following points should be kept in mind: (1) do not waste materials —a moderate film of dust evenly and thoroughly distributed will do the job; (2) do not include more active ingredient than is necessary; (3) when supply is short, reduce the amount of the main active ingredient in mixtures and substitute larger amounts of weaker or slower materials, i. e. finely-ground sodium fluosilicate, boric acid or borax; (4) **mixtures** of active ingredients, in general, are more effective than when the materials are used alone with a carrier, and less material is required for good results; (5) substitute synthetics should be given a good trial; (6) the highest quality and finest grades of material available should be used; particle size is an important factor in both active and inactive ingredients; (7) use suitable diluents; good insecticides may be wasted by poor carriers; (8) use the best equipment available and less material will be required; (9) apply dusts thoroughly, taking advantage of every crack and inconspicuous place into which a powder may be forced and left undisturbed. In this way, too, better results may be obtained with less material.

In short, by using the best of equipment and improving technique, utilizing extenders and substitutes, and avoiding waste, materials in short supply may be made to go a great deal farther without any sacrifice in the effectiveness of roach control.

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* Contribution No. 2309, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

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"This exterminator or insecticide contains (name and percentage of poison), a deadly poison. Do not use this powder where it may contaminate food products. The accepted antidote for this poison is: (describe antidote) . . . Distributed by: Name . . . address . . . "; (2) powder must be colored nile blue; (4) food handlers must not have any insecticides or exterminators on their premises that do not conform to the other provisions of this ordinance. Recently in Detroit a white powder insecticide was mistakenly used for flour in a restaurant, resulting in a multiple death episode.

Relationship of Pests To Health

By **Dr. E. R. KRUMBIEGEL**, *Commissioner of Health, Milwaukee, Wisc.*

Before Special Meeting of the Pest Control Industry of Wisconsin, sponsored by Milwaukee Pest Control Association, January 22, 1944, Plankinton Hotel, Milwaukee, Wisc.

MR. CHAIRMAN, and Members and Guests of the Pest Control Association: I have had a feeling for some time that it must be kind of nice for those of you who work within the Pest Control Industry to be working in an industry where you can call a louse a louse when you want to, without insulting anybody. That is something we can't always do in other types of work.

I was asked to talk to you this afternoon on "Relationship of Pests to Health," and we can jump right down from that type of title to this type of statement, that the relationship of pests to health is almost in its entirety the relationship of insects to health.

Now, the relationship of insects to health is a great study within itself, and we term that study medical entomology; that is, we in medicine term it medical entomology. Now, medical entomology is not an old science. Medical entomology really is only about sixty-six years old. Its beginnings were with a doctor by the name of Manson, in China, who, I think it was in 1878, first found that a certain tropical disease that we know today as filariasis could be transmitted by a certain type of mosquito that we call Culex mosquito. I don't want to bore you with a lot of terms of that type but, incidentally, filariasis is that thing we are destined to hear much more about in the future, at least the next ten to twenty years, than we have ever heard of in the past, and while it isn't a problem and never will be a problem of tremendous significance in this country, many of the boys who are coming back and will come back from the South Pacific will come back with filariasis. The point I want to make is that medical entomology is not an old science, and yet it is a science that has grown with astounding rapidity in the past sixty-six years.

There are certain things that are peculiar about diseases that are spread by insects. Some of them are spread only by insects. They can be spread in no other way. In other words, we say that the transmission is biological in nature. The insect is a necessary step. The transference cannot occur in nature without that insect; for instance, the mosquito in malaria. On the other hand, sometimes the transference can occur without insects, but the insects can also act as a transferer of the infective agent. For instance, typhoid fever. You don't need an insect to complete the chain of transmission from one person to another but, on the other hand, the fly may serve as a transmitter. I think that was brought out to a certain extent in the movie.

All blood-sucking insects are dangerous. There are many that are not blood-sucking, too, that are dangerous, but all blood-sucking insects are dangerous, although not all in the same degree. I said something about biological transmission of disease. Now, certain of our blood-sucking insects are biological transmitters. The disease is not transmitted in nature without that particular blood-sucking insect. For instance, malaria with its Anopheles mosquitoes.

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Then we have such things as a mechanical transmission, as typhus fever, through the louse. Then, of course, we have the infections that enter incidentally after the biting insect has punctured the skin. After all, the skin is the membrane that keeps out of our body the myriad of bacteria that we come in contact with every day, and before they can enter our body, at least through the skin, there must be some puncture, and of course insects do produce such punctures.

Then we have to think, too, of new diseases. We undoubtedly are having born, not every day a new disease, but there is every day a process of birth going on of some new disease. I probably have not made myself clear on that, but in the disease transmission through insects we have three necessary factors. We must have the parasite; that is, the organism that produces the disease; we must have the insect; and we must have the host, that is, the person or animal who suffers from the disease.

Now, sometimes different organisms, or at least certain organisms are very elemental in their nature, particularly the viruses, these organisms that are so tiny that you can't see them with any type of microscope. Now, these elemental types of organisms can be rather easily adapted to different modes of life, and, therefore, there is no doubt but that certain processes are going on all the time which are aiming at the adaptation of that particular organism to a particular insect and, in turn, to a particular host, a particular person or animal.

In order to make that a little bit clearer, in turn, I might say that only a few years ago a certain type of encephalitis began to attract attention in this country. We speak of it technically as equine encephalomyelitis. Now, a great deal of work has been done on this disease in the few years that it has been known, and we know that it is transmitted by three different genera of mosquitoes and by certain tics. Now, it seems peculiar that if this disease has been existant for many, many years, for centuries, that some competent medical observer would not have seen fit to describe it as we know it today. In other words, there is a feeling on the part of medical men that it is a comparatively new disease, something that has developed and which has adapted itself not only to man as the host, but to a wide variety of animals, and has adapted itself, in turn, to three different genera of mosquitoes, as well as several types of tics, and we are destined to see that type of thing in the future.

The reason I bring that out is to point out to you that this subject is not a static one about which we know everything today, but it is one that we know, I might say, too little about, and one which will grow in the future, not only in the application of insecticides to the things we already are familiar with, but we will see new diseases in the future that will be transmitted by insects.

Now, then, what do we do about the control of insect-borne diseases? Well, from a medical viewpoint we try to attack this chain of transmission somewhere, and usually in its weakest link; in fact, always in its weakest link. For instance, for some diseases we try to attack the insect, because that is the weakest link in the transmission chain. It is the one that we can most readily attack. For instance, in malaria, we attack the mosquito, we attack the adult mosquito. We attack the breeding place of the mosquito. I don't want to spend too much time discussing detail. Then sometimes we attack the parasite, itself. I can use the same disease as an example; we can take malaria again. There, again, we attack the parasite within man. We try to clear up the chronic carriers of malaria, so far as it is possible to do so. Then sometimes we attack the host. Unfortunately, we can't attack man; we can't kill man to eradicate a disease, because we would be defeating our ultimate aim. But where we have an intermediate host, or where we have a host who is normally the ultimate host—and man is only an incidental host—there we can attack the normal host. A good example of that, of course, is plague, where the rat is the normal host and man is more or less of an incidental host, and there we direct our attack at the rat.

Now, there are a tremendous number of insect-borne diseases, and I have no intention here, this afternoon, of spending a great deal of time discussing or even mentioning all of them, but there are many, many of them, and particularly do we see a tremendous number of them prevalent in the tropics. There are diseases that are spread by mosquitoes, there are some that are spread by flies, some diseases in which the fly is the biologic transmitter of the disease; not just an incidental transmitter, as in typhoid fever, but where he is an actual transmitter as in African sleeping sickness. I could go on and mention for you a great many diseases.

Now, we say to ourselves, "How many diseases do we have in this community that are transmitted by insects that are dangerous to man?" And I can say, so far as the life of man is concerned and the jeopardy to that life, we have comparatively few.

We can talk about malaria and the fact that approximately five million people die of malaria every year in this world. It is one of the great killers. We can talk about many other diseases and how many people die of them each year in the world, but the fact is in this community we have comparatively few diseases that are transmitted by insects that are exceedingly dangerous to man.

I have a few notes here, and I am going to skip over most of this material and begin to talk about the exterminator's work and health. Probably in what I have to say I will include about ninety per cent of the objectives at which the exterminator aims. I don't have the time to mention all of them. But let's consider rats and mice first.

Sure, we can say that rats and mice are spreaders of plague, in that they harbor the flea which spreads the plague from rat to rat and which may spread it to man, but do we have plague in this community? I don't believe there has ever been a case of plague reported in the State of Wisconsin. It is endemic in California and it has gradually moved eastward, until we find plague-infested rats have been located in Minnesota—that is, in nature—and in Iowa. To the best of my knowledge, they have not been reported in Wisconsin, but undoubtedly some must be here. Some squirrels or rats in this state must be infected with plague, because it would seem very unnatural to think that we could have it in Minnesota and in Iowa and not have it in Wisconsin. So we do have a possibility of a widespread dissemination of plague infection in the rats of this state, and when we have that established, even though we may not have it established today, we will have a situation which is potentially very dangerous.

Now, what else does the rat or the mouse do? The rat and the mouse both can act as transmitters of a type of jaundice condition that we speak of as Weil's disease. The organism that causes it has a rather tricky name. It is known as Leptospira icterohemorrhagica. Yet we know it exists here because we have actually had contact with one individual who contracted the infection right here in the City of Milwaukee, contracted it from association with rats or mice, or both, in a cattle feeding shed of a local packing plant. And yet, to the best of our

knowledge, that is the only case that has occurred in the community, at least the only proven case.

We know, too, that mice can transmit a type of encephalitis, a very mild type of encephalitis, an infection of the brain which we know as lymphocytic choriomeningitis. We have had a few cases of this in this community in the past eight or ten years. Whether it was transmitted by rats or mice, we are not able to prove. Rats can serve as mechanical transmitters of infection. After all, as you saw in the movie, they run around through garbage and they run over places where people have expectorated, and so forth, and naturally they can act as mechanical transmitters.

Let me tell you about some of the things we are not so inclined to think of. Public health is an exceedingly broad field, and it includes the field of mental hygiene. Rats destroy buildings, and oftentimes destruction of buildings is a public health problem. They destroy and they soil food. And is food destruction and soilage a public health problem of any importance? Absolutely, it is. Rats sometimes bite people. In the past four or five months we have had two individuals bitten in this city. Is a rat bite important from a public health viewpoint? Absolutely. But of a great deal of importance is the insult to our esthetic sense. That is important, and it is present here today in this community, and in every community of any size that I know of. For instance, what about the mother who hesitates to send her children out in the yard to play because she knows there are rats in the vicinity? She knows not only that the presence of rats is an insult to her own esthetic sense, but is an insult to the esthetic sense of her children. That is no small consideration at all.

Let's talk briefly about bedbugs. In the film the statement appeared that the bedbug was a transmitter of disease, and it is perfectly possible for the bedbug to act as a transmitter of disease. However, I know of only one disease in which it has been shown that the bedbug is a biological transmitter, and that is a disease that you have probably never heard of. It is called Chagas' disease, and it is prevalent in some places in South America, particularly in Brazil. I happen to have lived in Panama at one time, and I assisted in a postmortem which later on turned out to be a case, in fact the first case of Chagas' disease ever reported in Central America.

Now, of course, it is possible for the bedbug to transmit disease if the bedbug should bite a person who was coming down with typhoid fever and had the typhoid organism circulating in its blood, and shortly thereafter bit somebody else. It could act as a mechanical transmitter, but we have been unable to prove it is a transmitter of any importance of any disease except Chagas' disease.

Does that mean it has no significance in the field of public health? Absolutely not. First of all, the bedbug is a tremendous disturber of sleep, and sleep is of importance in the maintenance of health. A person must have had contact with bedbugs to realize how much your sleep can be disturbed by them. I have had such contact twice, once in an abandoned lumber camp in northern Wisconsin, and once at a railroad sort of hotel located within thirty miles of Milwaukee. After I began to wonder what was disturbing me and bothering me, I got up and turned on the lights, and I saw that the bed was literally alive with bedbugs. You can rest assured that I wasn't able to sleep the rest of that night.

Again, bedbugs offend the sanitary decency of the individual. They are an insult to our esthetic sense,

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again. They cause a great deal of worry. I mean the conscientious, cleanly individual who is trying to maintain a sanitary type of home, finding that in some way bedbugs have been introduced into the home, worries about the situation a great deal until they are eradicated, and worry is a prime cause of mental unrest and dissatisfaction which does have, in turn, a marked effect upon the health of the individual.

Let's talk for a minute about roaches. I don't know of a single disease for which the roach is a biological transmitter. In fact, there never has been such a disease reported, to the best of my knowledge. That doesn't mean the roach may not serve as a transmitter of disease, as a mechanical transmitter. After all, roaches get in every nook and cranny, and they may come in contact with some infective material and then walk over the pie or the cake that you later eat. How often this happens, we have no way of knowing or proving.

But, aside from that, roaches do destroy food. It isn't only the quantity that they eat but the quantity they destroy through soilage, through contamination with their excretions, and that destruction of food is important from a health viewpoint.

Again, the presence of roaches offends the sanitary decency of the individual, and that offense to sanitary decency interferes with appetite. For instance, if you sit down in a place and have a nice meal set down before you, and you see a cockroach run across the corner of the table, you know what happens to your appetite; you have lost it. You may have spent some money having a Martini or a Manhattan as a stomachic just before to stimulate your appetite, and yet one roach running across the table cannot only destroy the benefits that have accrued from that Martini or Manhattan, but this roach will do more; it will absolutely destroy your appetite, and your tendency is to push your chair back, push the plate away from you, and get up and walk out of the place. And if you don't do that, you certainly aren't going to eat with much relish.

Again, the individual whose habitation is infested with roaches has a source of worry. It is a source of worry to the conscientious businessman.

Let's talk about ants briefly. I don't know of a single disease, again, in which the ant serves as a biological transmitter. Of course, the ants crawl here, there, and everywhere, and it is possible for them, as I have enumerated before, to serve as mechanical transmitters. It is impossible for us in the field of epidemiology to say, "So many cases of this disease resulted from transmission of the causative organism by ants." So we have no way of knowing how much disease is transmitted by ants. But ants do destroy property, and property is often of importance in the field of health. Ants oftentimes destroy food. But, again, their great disadvantage to us in the field of public health is their offense to the sense of sanitary decency. You don't like to go into someone's home for a luncheon, probably after you have been playing cards in the evening, and go out and see ants walking all over their sink. If that person later on serves you a sandwich, you might be very hesitant to eat it.

Think of the worry that ants, through their presence, cause housewives. Last summer, in my own home, we had ants, and my wife was frantic for a while trying to get rid of them. She would ask me what she should do. I would say, "Just handle it." I was too busy to give it any consideration. She stewed around for a couple of weeks with these ants. The situation was going from bad to worse. I could notice her growing irritable, and apparently her difficulties were because of such an insignificant thing as an ant.

Let's consider, too, moths and silverfish. I don't know of a disease transmitted by moths or by silverfish. Again, silverfish might act as mechanical transmitters. How much disease they produce, if any, there isn't any one can state. But they do produce tremendous destruction of property, as was brought out in the film you saw.

Moths are producers of accidents. How you ever thought of that? The person who sees a moth flitting around is so intent on watching that moth and striking him that he is apt to stumble over a piece of furniture or some article on the floor, and in that way moths are a source of accidents. Again, moths produce a tremendous amount of worry. Anyone who has ever had a moth-infested home knows how much worry moths can really produce in the minds of the householders, and worry, after all, is a tremendous problem in the field of public health. People may worry about the size of their income, and so forth, and of course you can't expect a health department to set right all the economic ills of the world, because worry happens to produce mental reactions which sometimes go on to the production of neuroses or psychoses. But, on the other hand, it is surprising how much petty strife arises within households as a sole result of apparently insignificant things that produce worries, and you see it reflected not only in the parents, but, in turn, reflected in the parents' shortness and attitudes toward their children. So don't overlook, by any means, the problem of the worrying individual, or at least don't think it is nothing to be considered.

I would say that if we were to have some way of honestly weighing in the balance the damage done in Milwaukee County to the health of individuals by insects directly through their transmission of organisms, and put in the other pan of the scale the damage done through worry with its attendant mental developments, the scale would just flop down on the worry side.

Then, too, in the field of public health, pest control brings problems that are intimately associated with the health of the community, aside from the disease producing potentialities of the insects. In other words, we have no right to go ahead and say that we are going to use something to destroy insects, because the insects need to be destroyed because they make people sick. We have no right to say we are going to do such a thing if only a few cases of sickness or death result and, in turn, we must use something that is so dangerous that in the hands of untrained people may kill hundreds a year. In other words, the remedy must be safer than the disease, and I am speaking of fumigation through the use of dangerous gases, and I am speaking of the use of insecticides which are very deadly poisons.

For instance, let's take the type of thing that occurred in the insane institution, I think it was in Oregon, about a year or maybe two years ago now. All of you probably recall that. How many people do you suppose would have gotten sick in that institution, or would have died, if they had never used any insecticide to kill the roaches there? Probably none. And yet, as I recall the figures, it was something like a hundred, maybe somewhat more or less—I don't recall exactly—that died due to poisoning by sodium fluoride.

Then, again, we have people who think of the menace of rats to health, and think the rats must be destroyed, and are willing to go out without any type of training whatsoever and use substances that may actually kill more people than the rats through their diseases, at least in this community, would ever kill.

It is for that reason that we need laws, and it is for that reason that we have them. It is for that reason

Terminology of Insecticides, Fungicides and Other Economic Poisons

By ALVIN J. COX, *Bureau of Chemistry, State of California Department of Agriculture, Sacramento*

THERE IS FAMILIAR experience back of the terminology or nomenclature of common insecticides and other agricultural chemicals, but in the past few years many complexities have arisen. The situation may become serious when legal problems are involved. Not infrequently problems have been settled through conference between government officials and manufacturers so that correct terminology becomes familiar to the latter. Unfortunately the benefit derived from these conferences does not always come to the attention of others whom it may concern. It has happened that some time after a term has been clarified by resorting to legal regulation, a scientific treatise has appeared continuing the old misleading or ambiguous term. Few realize how solidly a term misused by an accredited technical investigator may become entrenched, and how difficult such an error is to correct.

Most entomologists and plant pathologists carefully report the exact species involved in their investigations and similar specificity is needed in mentioning a product or a chemical used in their experiments. Much of the value of some investigations has been lost due to ambiguity in terminology of insecticides, fungicides and other economic poisons (pest control materials). Use of incomplete, ambiguous or confusing terms should always be avoided. Some progress in this direction has been made. There have been great improvements in correct

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that we have laws, at least in Milwaukee, requiring the licensing of exterminators and fumigators. It is for that reason that we have ordinance governing the sale, coloring, and so forth, of insecticides. It is for that reason that we have rat ordinances, and it is for that reason that there are such things as restaurant and sanitation ordinances and general sanitation laws. So when we make laws of that type we are not doing it to hurt an industry; we are doing it to protect the public, and in most instances laws of that type not only protect the public, but, in the long run, are of great benefit to the industry.

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usage of such technical terms, and the writer has been encouraged to record illustrations that may be helpful. Difficulties in usage due to carelessness are correctible, but some are due to inadequacy of language. In such cases one can only recognize that ambiguity exists.

Definition of Common Terms.—Such words as **extender, diluent,** and **filler** are generally understood and used without confusion, and call attention to the role of an inert ingredient as a space filler in dusts. Although the term **carrier** generally signifies an inert ingredient, it implies the possibility of a more positive function, for example, the acidic or basic nature of certain carriers has a marked effect on the value of some active ingredients, and to that extent the substances deviate from the commonly accepted concept of an inert ingredient. As knowledge of the specific relations and functions of all the components of a dust increases, more terms may be required, each to be used with a precise meaning. Some terms are occasionally used in advertising literature in an ambiguous manner and unless accurately defined are without specific significance, for example: "Superfine," "Colloidal," "Penetrant," "Buffer," "Deposit builder," "Improver," "Dissociant," "Wax solvent," "Disperser," "Safener," "Conditioner," and "Lubricant." They are mostly used only as a vague connotation of a desirable characteristic and have no proper place in scientific literature unless adequately defined. This has been done in the case of certain of these terms. For example, in 1938 with respect to sulphur the writer proposed that to be called "Dusting," 95 per cent of the sulphur should pass a 200-mesh screen; "Fine," 90 per cent should pass a 325-mesh screen; and "Superfine," 98 per cent should pass a 325-mesh screen. A product to be described as "Colloidal" should have the properties understood by the physical chemist as being characteristic of colloids. The federal government has taken action against products labeled as being colloidal that actually consisted mainly of particles visible with the microscope and not sufficiently fine to be designated by this term. It is inappropriate to refer to a finely divided substance as colloidal unless the major part by weight is comprised of particles with a diameter not greater than 10^{-5} centimeter (0.1 micron). The term "Penetrant" is sometimes used to describe a substance that facilitates movement of an emulsion or other liquid into crevices or pores such as in soil or bark, to secure deeper penetration. A "Buffer" is a substance which when dissolved in water produces a solution which resists a change of hydrogen concentration when the solution is subjected to gain or loss of acid or alkali.

The term **adjuvant** or **accessory substance** signifies any material added to a primary pest control chemical or product when a function is not being particularly emphasized for it. In some cases a function cannot be defined in closer terms for lack of sufficient information. In general, no chemical action is involved between an adjuvant and any other component of a mixture, but the importance of an adjuvant is reflected in the efficacy of the products of which it is a part. Several terms are used to emphasize special functions of adjuvants, for example: **intensifiers, activators, emulsifiers, deflocculators, detergents, wetters, spreaders,** and **stickers** or **adhesives.** An **intensifier** is a substance a small quantity of which added to a material of low efficacy affords a pest control product effective for the economic poisons purpose intended. An example would be Pyrethrum Extract 20 when added to petroleum oil to produce fly spray. Such a substance is sometimes called a fortifier. An **activator** is a substance which may have little or no effectiveness of its own in pest control, but which increases the effectiveness of some other component of a pest control product. Synergism is a special case in which the substances involved are active ingredients, mixing of which produces a more than additive potency. The opposite effect is antagonism. An **emulsifying agent** is a substance which aids in the production or maintenance of a dispersion of one liquid within another. A **deflocculating agent** is a substance which aids in the production or maintenance of a dispersion of a solid within a liquid. A **detergent** is a substance used in aqueous medium to facilitate removal of foreign matter from solid material as, for example, in removal of spray residue. A **wetting agent** is a substance which increases the tendency of a liquid to make complete contact with the surface of a solid, so that no dry area may remain. A **spreader** is a substance which increases the area that a given volume of liquid will cover on a solid, or on another liquid. A **sticker** or **adhesive** is a substance which increases the firmness of attachment of finely divided solid material to a solid surface. Elaborations of these definitions are outside the scope of this paper, but some are described extensively in a series of articles having the general title, "Factors Concerned in the Deposit of Sprays," for the first number of which see Hensill, G. S. and Hoskins, W. M., Journal of Economic Entomology (1935) 28, No. 6, page 942. The effects of adjuvants differ under different circumstances, and sometimes one may have properties that qualify it under several of the definitions. In some cases a material mixed with one adjuvant makes an efficient product, but when mixed with a different adjuvant in the same proportion, results in a product of little or no value as an economic poison.

Emulsifiers may vary as to their compatibility with different products. For example, petroleum spray oil containing a given emulsifying agent may afford good results when used with water from one source and give poor results or be hazardous when used with another. Results may differ depending upon whether or not a constituent is adsorbed or absorbed, as the oxidation, volatility and rate of availability of a toxic substance may vary whether it is primarily on the surface (adsorbed) or located throughout each particle of a carrier (absorbed). This is another feature of the nature of insecticide dusts that is receiving increasing attention. When the effectiveness of an economic poisons spray or dust depends largely upon the adjuvant, the adjuvant is regarded as an economic poisons product and requires compliance with the Economic Poisons Article of the Agricultural Code of California. No attempt has been made to include in this paper a compilation, much less definitions, of all terms used in economic poisons work.

Ambiguous Terms.—There are many cases where ambiguity is not the fault of anyone in particular. Frequently it is necessary to make decisions on insecticide terminology before adequate information is available on the chemical constitution of a material. A case in point is the product formerly known as commercial calcium arsenate. It is manufactured with a standard composition to guarantee tricalcium arsenate 70 per cent. It may not be labeled "Calcium arsenate" which would indicate a relatively pure compound, but an acceptable name is "Calcium arsenate and other calcium compounds." It has long been guaranteed in terms of tri-calcium arsenate, but evidence now indicates that it may include one or a mixture of the several basic calcium arsenates. In that event, publication of tri-calcium arsenate percentages might be misleading by implication that one containing 71 per cent was slightly better than one containing 69 per cent, whereas one containing 69 per cent of the most active ingredient the nature of which is as yet

uncertain might be of greater value than another with a higher calculated percentage of tri-calcium arsenate, In time a more scientific terminology and statement of ingredients for this product may be possible. Incidentally, the same line of argument could be applied to calcium arsenite, which is highly toxic to plants and is used principally as an eradicant spray on dormant trees to disinfect plant twigs attacked or killed by some fungi.

There have been a number of cases similar to that of calcium arsenate where we have had to accept group or collective names even though they did not accurately describe the material. To illustrate, dry sodium arsenate may designate a number of different chemical compounds as does the term sodium arsenite. Certain federal authorities accept the term sodium arsenite to mean sodium metarsenite ($NaAsO_2$). In order to avoid ambiguity in California sodium arsenite solution is guaranteed in terms of arsenic trioxide. Zinc sulphate, manganese sulphate, iron sulphate, and copper sulphate may exist in several hydrated forms. For example, copper sulphate may be of anhydrous, monohydrate or pentahydrate form. A yardstick for products of this kind is to require metallic or other chemical equivalent to be stated on the label.

Nicknames.—Nicknames are misleading. Dry lime sulphur is too frequently referred to as "Dry lime." Both barium fluosilicate and barium carbonate have been loosely referred to as "Barium." In answer to a question if there was a spray residue tolerance for barium on vegetables, a man replied, "Yes, it is two hundredths of a grain per pound," which is the tolerance for fluorine. There is no tolerance established for barium. The abbreviated term "Arsenate" or "Arsenite" is indefinite when used to refer to a specific chemical, as it might refer interchangeably to a sodium, zinc, calcium, manganese, or other compound. It is not proper to refer to calcium arsenate as "Calcium." Similarly, it is inappropriate to refer to lead arsenate as "Lead," or to carbon disulphide as "Carbon" for one might think of lamp black. The term "Zinc" is confusingly used to designate zinc oxide or zinc sulphate. The term "Blood" is often used incorrectly to refer to **blood albumin spreader,** and **calcium caseinate spreader** ought not be shortened to "Casein" or referred to as merely "Spreader." The term **sulphur** means elemental sulphur and should not be used when reference is had to **combined sulphur.** For example, when one has stated gypsum or ammonium sulphate he has included the **combined sulphur** of the sulphate radical, and it is not permissible in addition to claim that the material "contains sulphur" as this would imply the presence of elemental sulphur. Aside from avoiding nicknames, great care is required in pronunciation and spelling to distinguish between similar legitimate terms such as **ammonium sulphate,** a fertilizer; and **ammonium sulfamate,** a weed killer. A somewhat similar but not identical liberty is discussed later with regard to use of nicknames for brand names.

The names of synthetic organic compounds are sometimes long and complicated because they designate much

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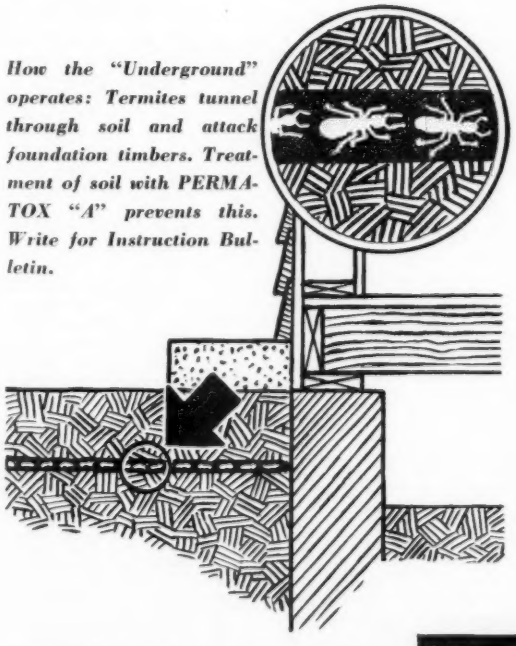

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detail of chemical structure. Audiences frequently smile when one mentions beta-butoxy-beta'-thiocyanodiethyl ether or dinitro-ortho-cyclohexyl phenol. Nevertheless, there are many thousands of compounds which chemists must differentiate in similar manner. The term "Dinitrophenol" has been indiscriminately used in publications to refer to a number of different insecticidal compounds now on the market, such as dicyclohexylamine salt of dinitro-ortho-cyclohexyl phenol and sodium dinitrocresolate. Actually dinitro-phenol designates a distinct, quite different chemical composition. When 2, 4-dinitrophenol was used as an obesity cure a few years ago severe injury resulted, and a separate law carefully worded not to apply to economic poisons was enacted restricting its medicinal usage. It is incorrect to use the term "Dinitrophenols" as a class name for compounds that contain any other group in addition to the two nitro groups.

In many cases a relationship has been established between chemical structure and known properties. If a compound has a chemical structure containing certain known groupings of atoms, the substance may be predicted as likely to have the characteristics of an insecticide; another known grouping, a dyestuff; or still another, as possibly having other industrial application. The class of compounds derived from the dinitrophenols seems to have both chemical and physiological properties in common. Class terms are usually created to avoid awkward expressions and repetition, and a term such as **derivatives of nitro phenols** may meet the situation.

Lethane is another term incorrect use of which has caused confusion, for no such product as "Lethane" is registered for sale in California. There are registered **Lethane 384, Lethane 384 Special,** and **Lethane 60,** all different products. One should take cognizance of even smaller differences in brand names. Unless a specific product is mentioned by its complete brand name or its common chemical name if possible, there is no certainty as to the material used. In lieu of a more exact expression the active ingredients in some of the mentioned "Lethane products" have been referred to as **Organic thiocyanates containing combined nitrogen xx per cent,** when proper figures are included in lieu of "xx." A more specific description is **Beta-butoxy-beta'-thiocyanodiethyl ether,** or **Beta-thiocyanoethyl esters of aliphatic fatty acids acids averaging 10 to 18 carbon atoms,** or a mixture of these. For these or similar products more exact terms may be possible, and the most nearly accurate name known should be used.

Misleading Terms.—There are a number of terms in insecticide terminology, the use of which should be discouraged as misleading. For example, use of the obsolete name "White arsenic" instead of the term arsenic trioxide and of "Copperas" instead of the term ferrous sulphate has caused considerable confusion in the minds of consumers, and these terms now have been abandoned by most manufacturers. Years ago one manufacturer insisted that a competitor "was selling sodium fluoride as a rat and mouse repellent powder," and was convinced that he was wrong only when shown "Sodium silico fluoride" on the label. The term **sodium fluosilicate** has replaced Sodium silico fluoride," to avoid confusion with sodium fluoride. Similarly **sodium fluoaluminate** is used in lieu of "Sodium aluminum floride." **Flour sulphur** refers to ground lump sulphur, whereas **flowers of sulphur** is a sublimed product with particles of a different type from those of ground sulphur. The term "Copper oxide" is indefinite and may refer to the cupric form which is black copper oxide not generally used as a fungicide. That used as an economic poison is cuprous oxide.

Chemical names as they exist and are used today have been developed as knowledge has increased. Years ago acid lead arsenate was the only type of lead arsenate produced commercially, and was called merely "Lead arsenate." Later **basic lead arsenate,** preferable for use on certain types of foliage, was produced. After several cases of mistaken identify and serious injury involving substantial financial losses where so-called "Lead arsenate" was sold in lieu of basic lead arsenate, we insisted that the name "Lead arsenate" be changed to read standard lead arsenate or acid lead arsenate. Since many manufacturers thought farmers would be prejudiced against using on their trees any product the name of which suggested acid, the term **standard lead arsenate** always has been preferred. The economic poisons industry has cooperated in every effort to lessen mistakes which might result in any injury.

The word "Nicotine" was formerly loosely used, and there has been developed a differentiation between **nicotine alkaloid** and **nicotine expressed as alkaloid.** As a contact insecticide or as a stomach poison a product may contain either free nicotine alkaloid or nicotine in chemical combination. Some fumigant type agricultural insecticidal dusts contain free nicotine alkaloid in an alkaline carrier, whereas most contain chemically combined nicotine, with a suitable carrier to free it. In the latter case it is customarily added to the carrier as **nicotine sulphate solution,** which is largely sold in the form of proprietary solutions. This has been sometimes mistakenly referred to as "Nicotine sulphate," which would erroneously indicate nicotine sulphate approximately 100 per cent.

The minimum concentration at which a chemical product ceases to be eligible for unqualified labeling has been given much thought. For example, it is not proper to designate simply as "Formaldehyde" a solution containing formaldehyde 37 per cent, nor simply as "Sodium fluoride" or even "Sodium fluoride dust" a powdered preparation containing sodium fluoride with talc, but these may be called **formaldehyde solution,** and **sodium fluoride and talc, sodium fluoride and talc mixture,** or **sodium fluoride and talc dust,** or by similarly acceptable qualified terms indicating dilution, admixture, or physical condition. It is the view of federal officials that a descriptive name should not be used for a product unless it is completely descriptive, and if a reasonably completely descriptive name is too long for use on a label or in advertising of an economic poison the practical thing is to employ a name which is not descriptive and follow the name with a statement of composition, such as "Contains sodium fluoride." California law does not necessarily require that the name of an inert ingredient be divulged. If the ingredients are completely divulged on a label, one should be more lenient in accepting a name than if the composition were not disclosed to the user. The words, dust or powder, indicate that an economic poison is in a form suitable for insecticidal dusting or that it is finely divided. Authorities agree that when a second substance has been added, the name of the resulting product shall not imply that it consists of a single component. A proper labeling is illustrated by **standard lead arsenate with adhesive.** On the other hand, common impurities may be great enough to rule out a name involving purity. More than 5 per cent impurities may prevent a product being acceptably called by a name implying purity. Wherever possible coordination of state policy in such matters with the federal government is achieved. In ordinary usage the expression nicotine, derris, or pyrethrins dust is often used to designate any dust containing the stated material as the principal active ingredient or ingredients. A more nearly accurate use would be to speak of these as dust **mixtures** whenever a toxic substance is mixed with other ingredients, and use of the word **mixture** to indicate the presence of another ingredient is an acceptable term in California, inasmuch as in general the statement of ingredients will indicate the extent of deviation from the pure named active ingredient or ingredients.

In 1940 the name **bordeaux mixture** or "Bordeaux" was being loosely used in California to designate sprays of zinc, manganese, and iron sulphates, together with hydrated lime, for use on citrus trees, to alleviate certain plant nutritional deficiency disorders. The sprays were often combined with varying amounts of copper sulphate and hydrated lime for its value as a fungicide, but they were used separately as well. After discussion it seemed clear that a specific significance should be attached to this important agricultural substance and that California should restrict use of the term to its original meaning. Accordingly it was agreed that the term **bordeaux mixture** or "bordeaux" in any form, combination or spelling shall refer only to the reaction products of copper sulphate and lime in any suitable form and water, and cannot be accepted where no copper is present, nor can the term be extended

to new variations, such as to mixtures of zinc and iron salts. We ultimately ruled that the term must not be applied to an economic poison containing any zinc, manganese, or iron salt added to a copper sulphate pentahydrate (bluestone) and lime preparation, that a term such as "bordeaux mixture with zinc" is not acceptable, and that modified materials shall have modified names stating what they are, for example, **zinc and copper sulphates mixture.** Occasionally an author uses the second figure in a bordeaux mixture formula, such as 8-8-100, interchangeably to mean calcium oxide, CaO, or hydrated lime, $Ca(OH)_2$. The form of lime should be stated along with the formula, or plant pathologists should reach an agreement as to what the formula should signify, in order that this important matter be not left in doubt. To afford the same chemical equivalent, one-third more by weight is required of calcium hydroxide than calcium oxide. In order to designate bordeaux mixture standards the writer employs present accepted usage of the more convenient unit such as 8-8-100 instead of the old 4-4-50, the 50 referring to the 50 gallon capacity old-fashioned barrel spray rig. Usage of 100 gallons as the unit is meeting with increased favor as modern commercial spray rigs have tanks with a capacity of multiples of 100 gallons. Carelessness with regard to the significance of the figures in bordeaux mixture formulas may account for conflicting results.

Many can remember the old confusion with regard to lime-sulphur solution, when in California it was necessary to resort to a legal definition of the product in order that use of the term might have some definiteness of meaning. The term **lime sulphur solution** is reserved for solutions containing calcium polysulphide not less than 29 per cent and having a density of not less than 31° nor more than 33° Baume at 60°F. Specifications had to be set up defining creosote, sodium arsenite solution, and some other substances as well as grades of petroleum spray oils. It has been possible from time to time as methods of analysis have been developed to establish further standards. Before pyrethrins analyses were officially recognized, many applauded early adoption of a so-called standard pyrethrum extract 20 to 1 product which gave the kerosene extractive of twenty pounds of pyrethrum flowers to one gallon of extract. This was a step in the right direction, but was still ambiguous inasmuch as the twenty pounds of flowers could vary greatly in pyrethrins content, and the efficiency of extraction could differ. The pyrethrins may vary from 0.6 per cent in Dalmation flowers to 1.3 per cent in those from Kenya. Our analyses have shown some so-called 20 to 1 extracts to contain but half the percentage of pyrethrins contained in other such products. The legal method for determination of pyrethrins I in pyrethrum powder is that designated as "Official" by the Association of Official Agricultural Chemists, and any guarantee in California is checked by this method.

Names of Botanicals.—The term **extract of pyrethrum** should not be shortened to "Pyrethrum." "Extract" is indefinite until the pyrethrins are guaranteed by percentage. The federal government accepts **insect powder** to mean powdered pyrethrum flowers, and the unqualified term cannot be acceptably used to refer to any other material. An appropriate term might be **pyrethrum insect powder** since there are other just as truly insect powders, for example, **sodium fluoride insect powder,** and **derris root insect powder.** In referring to botanicals containing extractives of rotenone bearing roots accuracy requires use of the name of the particular root. Most rotenone containing products are derived from three different plant genera: **Derris** species grow in British Malaya, the Dutch East Indies, and the Philippines, and formerly constituted the most important source of rotenone. The common name, derris, always refers to plants of the genus **Derrsi. Lonchocarpus** species are found in South America and now constitute the principal source of rotenone in the United States. These species have a number of different common names, depending upon the location in which they are found. For example, they may be termed cube in Peru; barbasco in Peru and Brazil; timbo in Brazil; haiari in British Guiana; and by various other names in other countries. **Tephrosia** species, which is synonymous with **Cracca** species, are found in North and South America, Africa, Asia and Australia. These species may also be called cube and barbasco in Peru; timbo in Brazil; or barbasco in Guatemala, Colombia, and Mexico. Results published in the magazine **Soap and Sanitary Chemicals** (1942) 18, No. 9, p. 95, indicate that the domestic plant **Tephrosia virginiana** may be successfully substituted for derris and cube roots to obtain sprays with a high degree of toxicity to houseflies. In critical testing a knowledge of just what plant is being used is important, because even though the rotenone content may be the same for the various roots, the extractives other than rotenone will differ to an important degree for a given percentage. For this reason, in addition to rotenone percentage, it is important that the root be named in stating derivation of **other ethyl ether extractives**, sometimes called "Rotenoids." The term "Rotenoids" is not synonymous with other ethyl ether extractives and applies only to rotenone-like substances other than rotenone itself, and it would be incorrect usage of the term "Rotenoids" to apply it to insecticidal compounds of an entirely different nature from rotenone that may occur along with rotenone in some plants.

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Phenolic Compounds.—The term cresylic acid has been loosely used to include variable mixtures of many associated phenolic compounds, both from coal-tar oils and petroleum oil. The term "Carbolineum" has been used to refer to a general anthracene oil fraction or to an emulsified coal-tar oil, and should be clarified. The term "Crude carbolic acid" in the past has been used to designate coal-tar distillates of variable compositions of phenols and neutral oils so that under that terminology it might have been possible for a product labeled "Crude carbolic acid" to be almost wholly neutral oil and to contain practically no carbolic acid.

Petroleum Spray Oils.—Recognized types of petroleum oils for plant sprays are marketed under the terms spray oil emulsion, emulsive spray oil, and tank-mix oil. A **petroleum spray oil emulsion** is a mayonnaise-type emulsion of petroleum oil in water. Such a product contains oil approximately 80 per cent, and simply requires dilution with water before use. The more fluid ones are sometimes designated "Flowable." An **emulsive petroleum spray oil** is one in which an emulsifying agent soluble in oil has been added. Such a product contains petroleum oil approximately 99 per cent, and forms an emulsion upon addition to water with agitation. The term "Miscible oil" has been used to some extent to designate a dormant type emulsive product containing petroleum spray oil approximately 85 per cent with phenols and soap as emulsifying agents. This product was very important during the early period of spray oils but is seldom used now. It seems erroneous to refer to emulsive oils as "Soluble" inasmuch as they form emulsions and not solutions with water. **Tank-mix oil** is a term adopted to designate a petroleum spray oil to be used with an emulsifying agent and water, all of which are added to the spray tank and the mixture maintained as an emulsion or even dispersion by agitation during application. The terms "Straight oil" and "Unmodified oil," which may suggest crude oil, are hardly adequate, but are sometimes used in lieu of the more descriptive term **petroleum spray oil** in an attempt more clearly to differentiate it from emulsive petroleum spray oils and from petroleum spray oil emulsions. The term "Toxic oil" is misleading as it implies that oil itself is not toxic, and a satisfactory term to refer to rotenone and oil preparations is, for example, **petroleum spray oil and rotenone mixture, intensified petroleum spray oil,** or **petroleum spray oil with added toxicant,** the last terms having more general application.

Among the laity there is still considerable discussion of viscosities, but it is believed they are of secondary importance and greatest emphasis should be placed on distillation range. In California, foliage petroleum spray oils are classified into **light, light medium, medium, heavy medium,** and **heavy,** depending on the amount distilling at 636°F. Foliage spray oils that do not meet these distillation ranges must be labeled "Unclassified." Each class has a specified minimum **unsulphonated residue.**

In reference to a petroleum spray oil the term **unsulphonated residue** should be consistently used, although this has been sometimes stated in the literature as "unsulphonatable residue." The California Department of Agriculture method for determination of **unsulphonated residue** is recognized by the supplier and consumer of petroleum spray oils. It was reviewed and studied for several years by the American Society for Testing Materials, and the term and method were adopted in 1940 as official Method D 483-40. It was also approved as American Standard by the American Standards Association and designated ASA No. 00: Z11.41-1940.

Unsulphonated residue is a petroleum spray oil test developed from a method already in use nearly 40 years ago in the turpentine and the coal tar industries. In 1911 Mr. E. Bateman used this term in U. S. Forest Service Circular 191. Seldom, if ever, does a wood tar oil or a coal tar oil show any measurable unsulphonated residue. Unsaturated compounds of petroleum oil are those components not completely sulphonated or oxidized to a stable condition, and which have not been removed in the refining process. They have insecticidal value but are markedly toxic to foliage and plants. Many of these are removed by ordinary concentrated sulphuric acid under conditions of the unsulphonated residue test, and for practical purposes all are removed in the test by using 37 N H_2SO_4. The evolution of heat and sulphur dioxide during the test indicates extensive reaction rather than solution; however, the manner in which the constituents are removed is immaterial. The unreacted oil is read directly and reported as percentage by volume. Although the capacity of petroleum oil for reaction is augmented with an increase in the size of the molecule and the number of side chains attached, any percentage of higher saturated

hydrocarbons which are sulphonated or dissolved by sulphuric acid is small and believed negligible.

Mr. G. P. Gray, a former Chief of the Bureau of Chemistry, who originally adapted the method to petroleum spray oils, used the term **unsulphonated residue.** The test is to determine degree of refinement and toxicity, the higher the unsulphonated residue the greater the refinement, and affords a clue to any toxicity of a petroleum spray oil to plants. For example, a petroleum oil that contains unsaturated compounds 20 per cent will have these removed in the test, and leave the saturated compounds or unsulphonated residue which will be read as 80. One containing unsaturated compounds 10 per cent would show an insulphonated residue 90 indicating an oil less toxic to foliage.

When one uses the term **unsulphonated residue,** he is referring to that portion which remains unaffected by the official method, and this term is used when preparing tabulated data of the test. By using the term "Unsulphonatable residue," it is implied that no matter what is done, the petroleum oil residue remains unsulphonated under any and all methods and conditions. This is not true as different methods do not give the same result. Frequently it is difficult to determine the best term to designate an arbitrary test. **Unsulphonated** and "Unsulphonatable" may be thought of as past or future. As the terms are ordinarily used, they may be equally correct depending on one's starting point, but perhaps neither is exactly correct, except as a name. **Unsulphonated residue** is a standard test performed in accordance with a definite specific procedure, and should any condition of the test be changed the index figure would correspondingly change. It is an arbitrary rather than an absolute value. A similar situation exists with regard to viscosity of petroleum spray oil, where one also uses a definite standard method. The units are always given, for example, Saybolt universal, absolute, S.A.E., A.P.I., Redwood and Engler. When one states "70 viscosity Saybolt second oil at 100° F.," one is left in no doubt as to what "70" means, but clearly understands it refers to the Saybolt universal viscosity test. If it is clear that there is little or no distinction between the terms **unsulphonated** and "unsulphonatable," there should be no confusion. However, both refer to the same percentage figure; a regulation under California law requires that **unsulphonated residue** be given on the label for a petroleum spray oil; hence there does not seem to be justification for adoption of some other term for the test in California.

Superlatives.—Superlatives are equally undesirable as nicknames. Words such as "Concentrate," "Highly concentrated," "Extra strength," are usually not acceptable as part of a name of an economic poison. A product that is not concentrated cannot be so designated, otherwise it would be necessary to coin terms such as "Super-concentrated" to care for common concentrated solutions. To offer an economic poison for sale under a loose term or to employ such a term in discussion of it may confuse a user.

Invariability of Brand Name Products.—In the 1936 Annual Report of the State of California Department of Agriculture, Bureau of Chemistry, attention was called to the invariability of a brand name. A change of any kind in a brand name such as the change of a single letter or in the arrangement of words, makes a different brand name requiring separate registration. A short brand name is highly desirable and not a long one such as, "Global Combination Treatment Worm Capsules for Puppies and Dogs Weighing One to Ten Pounds," or "XYZ Special Solution No. 57 Moth Spray and Fumigant for Steam Laundries and Dry Cleaning Services." It was previously indicated that there is no place for nicknames in chemical names, and there is none in brand names, and their use generally leads only to confusion. To avoid this, manufacturers should particularly discourage use of nicknames for their products. However, we do permit on labels and advertising an abridged brand name if the brand name is used correctly the first time, and there is a clearly worded note to indicate any abbreviation that will be used later in its stead.

There was a case where a manufacturer had two plant sprays with closely similar names. One was a petroleum oil spray suitable for application to foliage and the other contained in addition a small percentage of a different ingredient that made it suitable only for dormant application to deciduous trees. A grower who had long used the first product with satisfaction erroneously purchased and applied on foliage the second one carrying the similar brand name and sold in a similar package. Severe damage resulted. Each product was so labeled as to comply with the requirement of law. Each material was clearly distinguished in the mind of the manufacturer by long familiarity with his products, but opportunity for confusion did exist in the mind of the consumer, and the manufacturer was at least morally remiss in not having adopted more clearly distinguishable brand names. Consistent use of the exact name for each product will minimize the danger of confusion between products of different manufacturers and between different products of the same manufacturer. If a brand name is brief, clearly discernible, and not confused with unrelated words and signs, the tendency to use a nickname for it is reduced.

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Technical men and governmental agencies should be especially careful to refer to a product by an accurate descriptive name, whether it be the chemical name or a commercial name. Federal and other bid proposals should be specific and incapable of misinterpretation. In California manufacturers are required to maintain from year to year a uniform or improved composition or quality for each brand name product, and to indicate by at least an identifying change in name any variation made in the composition. Some leeway is given manufacturers when it is necessary to alter a composition due to priority ruiings, allocations, and the like, in order for them to continue manufacturing at all. An experienced investigator stated to the writer that he worked for three years with a certain spreader with various results, and then found that the composition had been changed four times during the interim. There is no objection to change, per se, but California requires a distinguishing mark to identify each revised formula. When a brand name of an economic poisons products is mentioned, care should be taken always to use it identically as it has been registered. Technical men in general should try to give specific chemical names of any materials or mixtures used. When this is impossible, in their publications some investigators follow the practice of reporting proprietary materials by describing certain constants and footnoting the reference with a brand name so that exact compositions may be checked with the manufacturer. This seems a fairly safe rule to follow when it is necessary to work with proprietary products. Manufacturers of pest control materials should guarantee as the active ingredient or ingredients, the exact chemical, if known, and show its equivalent percentage in terms of chemical elements, if equivalents tend to simplify the guarantee.

Conclusion.—Technical language requires clear, precise, and adequate expression. Correct terminology for economic poisons is not only of importance to users and manufacturers to assure maximum results, but also an aid to entomologists, plant pathologists and chemists interested in advancing the knowledge of their work.—9-5-43.

Reprinted from Jour. Econ. Ent., December, 1943.

PCO QUIZ—No. 5

(Continued from Page 10)

41. Mechanical controls refer to (1).....trap crops, (2).....resistant varieties, (3).....fly swatters, (4).....regulatory measures.
42. An insect, such as the aphid, which gives birth to living young is said to be (1).....omnivorous, (2).....viviparous, (3)..... oviparous.
43. The stages of growth in the development of the developing insect are said to be (1).....molts, (2).....instars, (3).....ages.
44. Silver fish feed principally on (1).....silk, (2).....wools, (3) .....cotton, (4).....sized fabrics.
45. Mosquitoes are major pests in the present war because they carry (1).....yellow fever, (2).....malaria, (3).....typhus, (4).....trench fever.
46. House mice are difficult to destroy with many poisons because: (1).....they consume very little food, (2).....they consume very little food at one time, (3).....they detect the poison in the poisoned bait, (4).....they have no spleen.
47. Insects which lay eggs are called (1).....oviparous, (2)viviparous insects.
48. Insects in which the growing stage looks like the adult, except for the size of wings, and has the same kind of mouthparts as the adult are said to have (1).....incomplete metamorphosis, (2).....complete metamorphosis.
49. The case in which the eggs of a cockroach are placed is called (1).....exuvium, (2).....an oothecum, (3).....a diapause, (4) .....an esophagus, (5).....a Nazi.
50. The growing stage of an insect which develops by complete metamorphosis is called (1).....nymph, (2).....prepupa, (3) .....cocoon, (4).....larva, (5).....the young.

Answers To Multiple Choice Questions

26. Calcium cyanide
27. Respiratory System
28. Ant baits
29. (2)
30. (3)
31. (3)
32. Open flowers
33. Deguelin
34. Greater solubility
35. Fumigant
36. Contact insecticide
37. 300
38. Lice
39. Three
40. Nocturnal
41. Fly swatters
42. Viviparous
43. Instars
44. Sized fabrics
45. Malaria
46. (2)
47. Oviparous
48. Incomplete
49. Oothecum
50. Larva

Tests Conducted by the Bureau of Entomology and Plant Quarantine to Appraise the Usefulness of DDT as an Insecticide

By P. N. ANNAND, *Chief*, and Members of the Staff, *U. S. D. A., Agr. Res. Adm. Bureau of Entomology and Plant Quarantine.*

Introduction Discussion of DDT

IN THE EFFORT to find new insecticides for the protection of man and animals from attack by annoying and disease-bearing insects and to control species which destroy food and fiber, the Bureau of Entomology and Plant Quarantine is testing many different materials. The materials tested include those developed as a result of research by the Bureau, as well as some obtained from other sources, including those supplied by industry. The urgent need to locate substances that might be used as substitutes or alternates for insecticides the available quantities of which are insufficient to meet the needs has made it desirable to test many materials that are covered by private patents or protected by trade-mark names.

One of the proprietary compounds that has been tested during recent months is a synthetic organic chemical, 2,2-bis(parachlorophenyl) 1,1,1-trichloroethane. For convenience, the designation "DDT" has been adopted, being derived from the generic name "dichloro-diphenyl-trichloroethane."

This chemical was first prepared by Zeidler (1874 by allowing anhydrous chloral and chlorobenzene to react in the presence of concentrated sulfuric acid. Chemically pure DDT is a crystalline solid, practically colorless, almost odorless, and rather stable. It is insoluble in water but soluble in most organic solvents, and it has low volatility.

Its possible insecticidal usefulness was first made public about four years ago through the researches of Paul Muller in Switzerland, who reported its effect on flies, moths, and plant lice. The insecticidal use of this material is covered by a number of patents, all of which are assigned to J. R. Geigy, A. G. Basel, Switzerland. The initial application for a patent was filed in Switzerland on March 7, 1940. Two British patents, 547,871 and 547,-874, were issued to Rosling Morgan Hughes under date of September 15, 1942. The most recent patent is United States Patent 2,329,074, entitled "Devitalizing Composition of Matter," issued to Paul Muller under date of September 7, 1943.

It is understood that in Switzerland the material is available for agricultural uses under two trade names, **Gesarol Spray Insecticide** and **Gesarol Dust Insecticide,** and that the former contains 5 per cent of DDT in a diluent, wetter, and sticker, and that the dust mixture contains 3 per cent of DDT. A product containing 5 per cent of DDT for use against human lice is also marketed in Switzerland under the trade name **Neocid.**

Prior to the adoption of the symbol DDT to designate the active ingredient, a technical grade of the material manufactured in Switzerland was referred to as **GNB,** and a technical grade of the material manufactured in the United States as **GNB-A.**

Several articles dealing with the use of this chemical against agricultural pests have been published in Switzerland and Germany (Wiesmann, 1942a-c). Wies-

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mann (1942 b and d) also published the results of some experimental work with honey bees, and more recently a paper in a Berlin journal (1943) showing the effectiveness of the material as a residual fly spray. The insecticidal possibilities of this material have also been noted in various publications in the United States (Anonymous, 1943a-e).

The reaction of certain insects to DDT indicates that it is a nerve poison. The experimental work on its toxicity to higher animals indicates that there, also, it acts primarily as a nerve poison. It is distinctly toxic when ingested or dissolved in a solvent, such as oil, which can be absorbed through the skin. Its toxicity has not been fully explored. Preliminary data suggest, however, that the toxicity of the material as it may be applied to control at least certain pests is of an order that may make its use as safe as some of the insecticides now employed. In any experimental use as an insecticide its low solubility, low volatility, and stability should be kept in mind. Experimental work in the Bureau indicates that the loss of DDT by evaporation from spray deposits will occur too slowly to decrease its effectiveness appreciably.

At present DDT is under allocation by the War Production Board, and the supplies available are not adequate to provide for general or civilian use.

Preliminary tests suggest that DDT is one of the more promising synthetic organics that might be used to control insects. Informal comments that have been made concerning it and references in available foreign literature have aroused rather wide and general interest, and there has been considerable informal discussion as to its possible usefulnes. This wide interest and the desire for information on results of the tests stimulated by insecticide shortages point to the desirability of deviating from the practice usually followed in reference to reports on proprietary materials and to make public the results of some of the preliminary experimental work that has been done.

The following articles report some of the experimental work with DDT, largely as an agricultural insecticide, that has been carried out by employees of the Bureau of Entomology and Plant Quarantine during the short time that the material has been under experimentation. The work reported from the Orlando, Fla., laboratory was done for the armed forces under a transfer of funds, recommended by the Committee on Medical Research, from the Office of Scientific Research and Development to the Bureau of Entomology and Plant Quarantine.—12-1-43.

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SPIDER CONTROL*

By MORTON S. PRESCOTT

ACCORDING to the literature, the black widow spider is the only spider in the United States whose bite is considered dangerous to man, and it is therefore considered as an insect enemy of man.

Practically all other spiders are considered beneficial because of the large numbers of flies and other insects which they destroy for food purposes.

Spiders are annoying to man primarily because of the presence of their webs, and secondarily, because many people have an aversion to spiders, second only to their aversion to snakes. But because of the lack of economic importance, very little information on control is generally available. Such work as has been done has been directed principally against the black widow spider, and the universal recommendation for this species is the use of a creosote oil spray. Such a spray obviously cannot be used in or around houses, and for control of house spiders the general recommendations seem to be:

(1) Careful screening to keep out flies and other insects which serve as food for spiders.
(2) Brushing down the walls and crushing the spiders on the floor, at the same time spraying walls heavily with a standard fly spray and making certain that the egg sacs are crushed.

During the past few years we have made control applications for several "elevator type" buildings—large apartment buildings—along the lake front. The managements of these buildings have reported heavy infestations of spiders, and while there were no complaints or evidence of any of the tenants of these buildings being bitten, the presence of the spiders was a source of annoyance, and the managements, unquestionably motivated by the high rentals involved, requested that we undertake control measures.

A tentative identification of the spider involved, indicated that it was the **Aranea undata,** commonly known as the "bridge" or "dock" spider. This spider is from 10 to 15 millimeters in length. It is dark grey with light grey abdominal marks, which form a grey cross. It is normally found on houses or structures, which are located near or on the water.

The egg sacs contain between 200 and 400 eggs. The sac is usually fastened into a corner, crack or crevice and is then sealed in and protected by a webbing, which is spun thick enough and strong enough to hold the sac firmly in place and give it considerable protection. The sac, with this protective covering, is yellowish white in appearance, and is often about one-half inch in length. It is irregular in shape, depending upon the surface to which it is attached, for its formation.

A review of several of the inspections we made gives us some interesting sidelights, although the number made to date is not sufficient to draw any final conclusions.

In the first place, where we have inspected such infestations, we have found conditions progressively worse towards the upper floors of the building.

Secondly, the infestation was usually along the lake side (east side) of the building, although structural features did vary this finding. In one case the infestation was confined entirely to the south wall adjacent to an exterior fire escape. In another, the infestation was on a north wall and we attributed this to the fact that this wall had a series of ornate cornices on the upper floor

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levels, which we assumed gave shelter and protection for the spiders. In a third case the spiders were found around the entire perimeter of the building on the upper levels. In this building the architect had designed the building to give a somewhat checkerboard effect by having occasional bricks set in about 4 inches from the face of the wall. Many of these recesses were taken over by the spiders.

Another infestation, and one which gave us a possible clue as to why we found the spiders concentrated on the top floors, was at a two-story penthouse built 22 floors above the street level. On the west side of the penthouse was a complete victory garden. On the east side—the lake side—there was a lawn complete with terrace, and shade trees.

When we made this inspection we found the tiled terrace covered with thousands of Mayflies. This seemed to indicate that these Mayflies, coming off the lake, were caught in an updraft and carried to the roof and upper walls of this building, affording a very fine food supply for the spiders and making for ideal conditions for such an infestation. The same explanation can be offered for the other cases, as these were all high buildings on the lake front.

In planning control measures, it was obviously impossible to use the broom or brush method efficiently. Standard strength sprays gave a good kill on the adult spiders, but we found that the webbing protecting the egg sacs resisted the usual sprays, and we were not securing a satisfactory kill of the eggs. After experimenting, we developed the following formula, which gave us very satisfactory results:

Dispersol or Deobase	46¼%
Velsicol AR 50	46¼%
Lethane No. 384 Special	7½%

In explanation of this formula:

Dispersol or Deobase was used, not because of its "odorless" qualities, but because it had a much slower drying time than other oil bases we had in stock. The slower drying helped, in that the spray penetrated the egg sac webbing before evaporation stopped its action.

We found that the Velsicol AR 50 definitely helped to break down the protective webbing around the sacs, so that the spray was able to destroy the eggs.

The Lethane content was stepped up from 5% to 7½%, as the spray was being used outdoors and this concentration could be used without inconvenience or discomfort to the operator, and we felt that we would have increased insurance of a good kill with the higher concentration.

The material was applied as a very heavy spray—almost a stream—and care was taken to thoroughly flood all cracks and crevices where the egg sacs might be hidden.

We consider this work to be still in the experimental stage and these control measures were undertaken with a definite understanding with the various managements requesting the service, that the materials and methods used would not prevent re-infestation. As a matter of fact, we have found it necessary to treat the penthouse at least twice each summer. In the case of the building with the fire escape on the south wall, as in several other instances, one application each summer seems to bring satisfactory results. This does not mean that the premises were entirely free of spiders, nor that they would remain so. It indicates, rather, that the infestation was cut down so that there was little or no complaint from the tenants.

*Presented before the 8th Annual Purdue Pest Control Operators Conference, Lafayette, Indiana, January 17-20, 1944.

Toxicity of DDT to *Blattella germanica*, as Compared with Sodium Fluoride, Derris and Pyrethrum

By JOSEPH M. GINSBURG, *New Jersey Agricultural Experiment Station, New Brunswick*

DICHLORODIPHENYL trichloroethane, $(C_6H_4Cl)_2$-$CHCCl_3$, has attracted wide attention among entomologists and chemists, as a possible substitute for many of our present insecticides, some of which are, due to war conditions, either scarce or entirely unavailable for civilian use. Although this compound has been known to chemists for over seventy years, its insecticidal properties were only recently discovered in Switzerland, as described in two English patents (Nos. 547,871 and 547,874) 1942 and in one U. S. patent (No. 2,329,074) 1943 issued to J. R. Geigy Company operating in the U. S. and Switzerland. While its chemical formula corresponds to 2,2-parachloro-phenyl-1,1,1-trichloroethane, it has become known commercially as **Gesarol, Neocid** and DDT.

During the summer months of 1943, the writer has tested DDT against several species of sucking and chewing insects. This brief report presents results from laboratory tests on the German roach, **Blattella germanica,** in which the toxicity of of DDT was compared with sodium Fluoride, finely ground powders of derris root, and pyrethrum flowers.

Materials and Methods.—The insecticides were tested as dusts, the base of which was a mixture of 50 per cent talc and 50 per cent soybean flour. Various concentrations of the four insecticides were incorporated in this base-mixture. Sodium fluoride and DDT were chemically pure; the derris contained 5 per cent rotenone, and the pyrethrum analyzed about 1 per cent pyrethrins.

The tests were conducted by the following method. The insides of one-gallon glass jars, of uniform size, were dusted with the insecticide mixtures so as to thoroughly cover the bottom and inner walls. The excess dust was then shaken out, allowing only as much dust to remain as could adhere to the glass. Preliminary determinations have shown that approximately 140 mgm. of dust was required to cover one jar. Since the inner surface area of each jar was approximately 178 sq. in., the average amount of dust deposited by this method was about 0.8 mgm. per sq. in.

From 20 to 30 adult roaches, 10 weeks old, were transferred to each jar and, supplying them with water, were kept under observation for 48 hours. The main object was to determine the minimum concentration of DDT necessary to kill 100 per cent within a comparatively short period, as compared with the other three insecticides. Duplicate jars were used for each test.

The data presented in table 1 show that 7 per cent DDT and 33 per cent sodium fluoride were the minimum concentrations required under the described laboratory conditions, to kill 100 per cent roaches within 48 hours. DDT appears, therefore, to be about 5 times as toxic to roaches as is sodium fluoride. Dusts containing either 33 per cent derris or 33 per cent pyrethrum gave, within the same period, only 30 per cent and 90 per cent kill respectively.

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for destroying house ants

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for destroying garden ants

Thallium Sulphate, the only *tasteless* and *odorless* poison known, is the world's finest medium of ant control. Don't risk using substitutes that do *not* work.

Exterminators who want to use their own brand names can buy ANT TRAPS *UNLABELLED. Act fast*—because America's supply of Thallium Sulphate is limited!

SOILICIDE LABORATORIES

51 JAMES STREET MONTCLAIR, N. J.

In general, the results from these preliminary tests indicate that DDT is vastly more toxic to roaches than are sodium fluoride, derris or pyrethrum.

Table 1.—Toxicity of DDT to roaches as compared with sodium fluoride, derris and pyrethrum.

	% Toxic Ingredient in Mixture	Approx. % Toxic Ingredient per Sq. In of Surface	Total Roaches Tested	Average % Dead After 24 Hr.	48 Hr.
		mgm.			
	1 DDT	0.008 DDT	44	21	36
	2 DDT	0.016 DDT	53	32	63
	4 DDT	0.032 DDT	51	42	70
	7 DDT	0.056 DDT	61	80	100
	10 DDT	0.080 DDT	47	90	100
	10 NaF	0.08 NaF	62	52	82
	20 NaF	0.160 NaF	42	50	95
	33 NaF	0.264 NaF	44	85	100
	10 Derris	0.080 Derris	46	—	18
	33 Derris	0.264 Derris	47	22	30
	10 Pyrethrum	0.080 Pyrethrum	45	—	66
	33 Pyrethrum	0.264 Pyrethrum	40	70	90
Check (Base Mixture)	None	None	51	2	6

—*Jour. Econ. Ent., Feb.*, 1944.

Post-war Utilization of Aerosol in Household Insecticide Field Predicted at N.A.I.D.M. Meeting

IN A SYMPOSIUM on "Aerosols vs. Spray-Type Insecticides", at the thirtieth mid-year meeting of the National Association of Insecticide and Disinfectant Manufacturers, W. W. Rhodes, of Kinetic Chemicals, Inc., Wilmington, Del., predicted utilization of aerosol on a broad scale in the household insecticide field in the post-war era. Held in the Edgewater Beach Hotel, Chicago, Ill., June 12 and 13, the meeting attracted a record attendance of approximately 365, comprising members and guests.

The remarks of the speakers at the symposium were summarized by H. H. Stoddard, of Dodge & Olcott, Inc., who declared that there would be a sufficient and substantial market for both types of insecticides, especially since World War II has made the soldiers insect-control conscious.

Dr. Victor Froelicher, of Geigy & Co., N. Y., described the early work and pioneering done by his company in connection with the development of DDT. He also clarified some of the confusion which has been created by the different names under which DDT and its insecticidal compositions have appeared in literature during the past year.

Discussing the toxicology of DDT in a communication to the Association, Paul A. Neal, senior surgeon of the Industrial Hygiene Research Laboratory, Bethesda, Md., stated that restrictions were maintained by the National Research Council regarding the divulgence of the results of research on DDT. Restricted classification on the work was due to the fact that various formulas were studied when DDT was used either as an aerosol, mist, spray or dust, he indicated. Adding that the work dealth with dust, he indicated. Adding that the work dealt with methods, as well as skin absorption.

Research work carried out by the former Bureau of Biological Survey, U. S. Department of Agriculture, in cooperation with other bureaus of the Department of the Interior, relative to "Red Squill as a Raticide," was traced in a paper prepared by Dorr D. Green, chief of the Division of Predator and Rodent Control and presented by W. E. Riter.

Dr. Louis Schwartz, Medical Director of the U. S. Public Health Service, discussed "The Prevention of Occupational Dermatitis."

"How to Provide Adequate Employment for the Returning Soldiers" was explained by Newton C. Farr of the committee for Economic Development.

It was suggested at a symposium on post-war sprayers that if the insecticide industry would present specifications for a hand propelled, as well as an electric sprayer, the manufacturers would endeavor to produce such products.

A model insecticide and fungicide law was adopted by the Association.

In recognition and appreciation of his thirteen years as treasurer of the Association, John Powell, of John Powell & Co., N. Y., was presented with a silver after-dinner coffee service.

WHAT'S NEW IN PEST CONTROL-PERSONALS

A CHART OF STATE LAWS APPLYING TO ITS INDUSTRY has been compiled by the N.A.I.D.M. Two copies of this digest will be given to each member of the Association. Complete revisions will be made periodically as required—perhaps every two years. In order that the chart may be kept up to date, corrections and additions will be issued as they occur.

ANNOUNCE BIRTH OF SECOND CHILD

Mr. and Mrs. Henry E. Frye, of 1414 Main street, have announced the birth of an eight pound daughter, Eulala Joyce, Sunday, May 28, at the Good Samaritan Hospital at Vincennes, Indiana. She is welcomed by a sister, Patricia Alice.

AMONG THE VISITORS TO NEW YORK CITY in recent weeks contacting the Secretary were: Mr. and Mrs. Harlem Ives of Detroit, Mich., Mr. and Mrs. I. B. Carncross of Syracuse, N. Y., Mr. Justus C. Ward of the U. S. Fish & Wildlife Service, Denver, Colo., and Mr. William Wacker of the Louisville Chemical Co., Louisville, Ky.

INSECTICIDE CONTAINER PRACTICES NOW IN PRINT: Printed copies of Simplified Practice Recommendation R203-44, Containers and Packages for Household Insecticides (Liquid Spraytype), are available, according to the National Bureau of Standards. The recommendation includes the pint, quart and gallon packages as the stock sizes for retail trade. Standard shapes and finishes of the glass containers for these stock packages are also shown in the recommendation. The 5- and 54-gallon drums are designated as the stock sizes for industrial packages. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 5 cents each.

O. P. & D. R.

FLY FARM—A modern insecticide laboratory especially designed for the biological and chemical testing of Thanite, a toxic agent specified by the United States Army for its fly sprays, is now in operation at Brunswick, Ga. The laboratory includes a "farm" where flies are reared to be tested in three chambers at the rate of 15,000 a day.

PLAGUE-INFECTED RATS WERE DISCOVERED on a tramp steamer in New York Harbor in January, 1943. Because the ship had touched at several piers before the infected rats were discovered, the Public Health officials were greatly worried. However, after several months of watchful waiting and intense research, nothing was found to show that any of the rats had escaped ashore. "The Wyoming affair", as it is now

known, was vividly described in an article, "Thirty-Two Rats from Casablanca", in the April 29 issue of "The New Yorker". Written by Joseph Mitchell the article also presents some interesting facts about rats in general and quotes a number of exterminators by name on the subject.

Reprint facilities not being made available on the usual courtesy basis, it is suggested, therefore, that the reader contact "The New Yorker", 25 West 43 Street, N. Y. direct if he wishes a copy. (Cost 15c)

The Health Council of Allegheny County, Pa., recently issued a pamphlet containing detailed instructions on how to get rid of rats. "Extermination of the rat is a biological impossibility," this says in part. "The best that can be done is to suppress the rat, reduce his numbers and thus control his harmfulness and destructiveness. Even this is a gigantic task, and it will result only from continuous, cooperative and intelligently applied control measures."

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RATES — For individuals seeking employment, 5c per word, minimum $1.00. All others 10c per word, minimum, $2.00. All advertisements must be in the hands of the publishers seven days before publication date and must be accompanied by cash or money order for payment in full. The publishers are not responsible for any false or misleading advertisements.

Replies to advertisements where box number only is indicated should be addressed c/o PESTS, 512 E. 14th St., Kansas City 6, Mo., giving box number as well.

Well established, profitable, Pest Control Service, with enviable reputation, for sale. Located in Lower Rio Grande Valley of Texas. Box 984. Pests.

Exterminating business on or near West Coast wanted by highly experienced operator. Can pay Cash. Box 60, c/o Pests.

WANTED—Manager, experienced Pest Control Operator, Eastern territory; reputable firm. State salary, experience, qualifications. Box 945.

"A progressive firm in Northern New Jersey has an opening for an outstanding man as Manager of Service Department. Only top flight man, thoroughly familiar with all phases of Pest Control Work will be considered. Write giving full details of past experience, qualifications, etc."
WRITE BOX 60, c/o PESTS.

Termite Control Service and Sales Manager wanted by old reliable concern. Unusual opportunity for man who can qualify. Write full particulars, experience and salary desired.
WRITE BOX 25—PESTS.

WANTED—Three experienced Pest Control Operators to connect with a reputable firm. Midwest territory. State salary, experience, qualifications.
WRITE BOX 70, c/o PESTS.

LOCAL ORGANIZATION NEWS

Professional Exterminators Association, New York City

The Professional Exterminators Association of New York City held its annual election of Officers at The Hotel Commodore on Thursday evening, May 25, 1944.

Joseph Finneman was re-elected President; Milford H. Oachs was elected Vice-President; Jack Shaff, Secretary; and William Farrell was re-elected Treasurer. The following were elected Directors: Jack L. Huberman, Charles Pomerantz, S. B. Ascher, John Norris, Jack Benmosche and Murray Levine.

The Association has been very active this past year in educational endeavors and the membership has been increased by twenty new firms in the same period.

San Jose Local District Organized

The Pest Control Operators of San Jose Area recently met with President Arthur Eddy, and Secretary Ray Haneberg of the State Association, and organized as a unit to be known as San Jose District Association of the Pest Control Operators of California, Inc. All licensed owner-operators of the area were in attendance and joined to make the only district in the state of California where 100 per cent membership exists. The following officers were elected: Chairman, David Anderson; secretary, Ralph Tracy; treasurer, B. R. Byrd; state director, J. E. Baechler, and Mr. Ralph Tracy, alternate director.

Los Angeles District

The Los Angeles District May monthly meeting was held at Eaton's Chicken House. Seventy-nine operators atttended. The termite forum and questions and answers was the main subject of the evening. Being such an interesting subject there was not enough time to finish, so will be continued at the July meeting. The meeting came to a conclusion with the showing of the motion picture in color of "General Pests." Also the latest war picture of "Tarawa."

At this meeting was the start for the drawing of the attendance prize. If the member is present and his name is drawn from the bowl he receives $5.00. If the name drawn is not present the money goes over to add to the following week's prize. At this meeting, Tony Gordon of Monterey Park was the winner.

Chicago PCOs

On June 7, a meeting was held at the Sherman Hotel of the various committees that are going to make the Chicago meeting a success. Problems pertinent to a successful meeting were discussed and much progress was reported.

Among those present were:
Earl L. Salomon, Frederick Peres & Co.
Elmer Kuntz, Lien Chemical Co.
Morton S. Prescott, Protex Service.
J. M. Dorrans, J. McNeil Dorrans Ext. Serv.
Leo D. Postel, A. B. C. Exterminating.
J. B. Smith, A-Veri-Best.
J. R. Franklin, Hammond Ext. Co.
F. E. Garlough, Fish & Wildlife Service, U.S.D.I.
H. F. Bradfish, J. F. Cunningham Ext. Serv.
Arthur Tronsen, A. Armitage Pest Control.
James McDaniel, International Ext. Co.
A. J. Burdick, International Ext. Co.
A. Kapson, A. & B. Exterminating.
H. C. Kaufman, Pesticide Co.
Louis L. Paul, Nueva Fumigating Co.
R. E. Brawner, 13 Insect Co.
M. L. Enger, Airway Ext. & Products Co.
W. W. Windmeier, Airway Ext. Co.
Mrs. Agnes Clark, Chicago Ext. Co.
Miss Myrtle Miller, Chicago Ext. Co.
C. Norman Dold, Rose Ext. Co.
Walter S. McCloud, W. B. McCloud & Co.
G. H. Grossman, A. N. D. Exterminating.
Joseph DiFiore, A. Globe Ext. Co.
Miss Singer, Singer Sanitation Serv. Co., Inc.
Harry Delong, City Exterminating Co.

Among those present were the following Pest Control Operators:

William O. Buettner, Secretary, National Pest Control Association.
Walter S. McCloud, W. B. McCloud & Co., Chicago, Ill.
Morton S. Prescott, Protex Service, Inc., Chicago, Ill.
George L. Hockenyos, G. L. Hockenyos, Inc., Springfield, Ill.
Herman Militzer, H. & M. Laboratories, Toledo, Ohio.
Jules B. Smith, A-Veri-Best Exterminators, Chicago, Ill.
Ray V. Bechtel, Aristo Exterminating Co., Detroit, Mich.
O. L. Potter, Down River Fumigator, Ecorse, Mich.
C. Norman Dold, Rose Exterminator Co., Chicago, Ill.
W. W. Scott, Arwell, Inc., Waukegan, Ill.
E. A. Kuntz, Lion Chemical Co., Chicago, Ill.
Henry Turrie, Wil-Kil Inc., Milwaukee, Wis.

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Eliminate Use of Poison!
Require No Bait!

A practical and economical way to rid buildings of rodent pests! No hazards of poisoned bait . . . or of decomposition! Easy to prepare! Just place WIZO Rat Boards near rat hole or form a runway next to walls. Fasten boards to floor to prevent pulling away. Rodents are caught firmly the moment they step on the boards.

WIZO RAT GLUE can be obtained in quantities for preparing your own boards. Write for complete particulars.

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WRITE FOR THESE BOOKLETS

The latest helpful information service literature will be sent to you without cost or obligation. If, in addition, there are any particular pieces of literature offered by advertisers in this issue you are interested in receiving, either write them direct, or if you prefer, please send us such requests.

Please note, however, that you must request each booklet on a separate letterhead though they may all be mailed in one envelope addressed to Pests, 126 Lexington Avenue, New York City, N. Y.

SPECIAL ROACH POWDER

Circular describes a roach powder (containing Lethane A 70) which, it is stated, is fast acting, positive in kill and will not deteriorate for at least eight weeks after application. As a result, the supplier points out, the PCO does not have to service his customers as often, thereby conserving manpower. Moreover, it is stated, the powder is non-toxic to warm-blooded animals and may, therefore, be used in dairies, packing and food handling plants, homes, etc., in fact, in all places where sodium fluoride mixtures may not be used. . . . Described also is a sodium fluoride-Pyrane formulation for the PCO who wishes to make his own roach powder.

WRITE PESTS—Bosley.

SODIUM SILICO FLUORIDE

Bulletin describes sodium silico fluoride product with proper density. Effective manner of testing for presence of HCN after ventilation also discussed.

WRITE PESTS—AC 70.

MILITARY FUMIGATION MANUAL

This special 48 page manual has been prepared for the benefit of officers and civilians in the Armed Forces who are responsible for vermin control, and for PCOs who may contract with the Armed Forces for fumigating work. Among other subjects, the manual discusses: dosage, preparation of building for fumigation, fumigation operation, common pests, cockroach control; precautions, first aid methods, etc.

WRITE PESTS—AC.

TERMITE CONTROL

Folder discusses concentrates available for two distinct methods of termite control: (1) treatment of timbers in place with an oil solution, and (2) treatment of all soil around an infested building or area with either an oil or water soluble chemical. Issuing company states it specializes in all problems concerning wood-destroying organisms and also wood preservation and invites your inquiries thereto.

WRITE PESTS—WOOD.

FUMIGATION SAFETY SUGGESTIONS

Of timely interest, in view of the at-hand fumigation season, is this bulletin which advocates as a safety measure the use of methyl orange-mercuric chloride test papers for the presence of HCN. It also discusses can openers for Zyklon Discoids, the need for adequate ventilation after fumigations, and gives a cautionary note on pilot lights in premises to be fumigated.

WRITE PESTS—AMERICAN.

STERILIZING GAS MASKS

News bulletin describes a chemical that is claimed by the manufacturer to be effective in sterilization of gas masks. Bulletin also discusses antidotes and first aid, particularly an inhalant which functions best as an antidote to HCN poisoning, and where obtainable.

WRITE PESTS—A-C-73

FUMIGATION AND PLASTICS

News release discusses use-co-ordination of such diverse chemical products as plastics and fumigants in connection with infested bagged grain, seed, packaged or boxed foodstuffs. Methyl bromide-plastic-tarpaulin method of disinfestation described.

WRITE PESTS—DOW

RESPONSE OF RATS MAINTAINED ON DIETS FUMIGATED WITH METHYL BROMIDE

Research material reprinted from Food Research.

WRITE PESTS—DOW-RESEARCH.

PYRETHRUM - DERRIS - RED SQUILL PRODUCTS

Leaflet describes foregoing insecticides with special bait chart for use in connection with powdered red squill.

WRITE PESTS—PRENTISS.

SOLVAY PRODUCTS

48-page booklet in colors and illustrated, covering their entire line of Alkalies and Special Products, with a special section dealing with Para-Dichlorobenzene and Ortho-Dichlorobenzene.

FREE COPY MAY BE HAD BY PEST CONTROL OPERATORS. WRITE SOLVAY, c/o PESTS.

DEODORANT

Catalog includes price data, etc., on deodorant which it is felt can neutralize and deodorize such toxic agents as Thanite, Lethane 384 Special, Velsicol, etc. Also contains data on perfume oils for sprays made with pyrethrum and kerosene.

WRITE PESTS—MAGNUS.

FUMIGATION NOTES:

Discusses spread of Discoids; reinfestation; effects on vegetables and eggs.

WRITE PESTS, AC58.

ELECTRIC FANS

Bulletin discusses value of electric fans in connection with fumigation work, also some pertinent thoughts on the Schafer Prone Pressure Method of Resuscitation, etc.

WRITE PESTS—AC-69.

MOLE KILLER PELLETS

Circular describes mole killer pellets which manufacturer states requires no traps, no gas, no exposed poison. Diagram of runways and explains how mole lives. Testimonial letters.

WRITE PESTS—CARAJON.

PRESERVATION OF MILLWORK AND OTHER DRY WOOD PRODUCTS

Bulletin discusses composition of Permatox B Concentrate and its application in the preservation of millwork and other dry wood products.

WRITE PESTS—Permatox 43-B.

INSECT COLLECTIONS

Booklet describes pocket display case which may slip easily into a coat pocket making it of value for salesmen or others who travel about. Life history collections of structural type pests are also available for the PCO.

WRITE PESTS—Ward's.

SAFETY IN FUMIGATION WORK

Fumigation Safety Rule No. 1; namely, "Vacate entire building even though only part is fumigated, as well as adjoining buildings into which gas may penetrate" is discussed in this bulletin.

WRITE PESTS—AC No. 78.

PIGEON-PROOFING

Folder describes pigeon-proofing invention which manufacturer claims will completely and decisively eliminate the pigeon nuisance. In use by real estate companies, churches, government buildings, etc.

WRITE PESTS—STANLEY.

CONTROL OF TERMITES-POWDER-POST (LYCTUS) BEETLES-DECAY

Circular discusses properties and uses of Permatox A in termite control and its application to soil and wood to control termites, decay control, powder-post beetle prevention and control. Description of Permatox T and its uses in termite control, as a soil poison, are also discussed, together with toxicity.

WRITE PESTS—BULLETIN 43-T.

BOX CAR FUMIGATION

Folder describes box car fumigation with methyl bromide, giving details as to: car seal, applicator arrangement, methyl bromide application, dosage, exposure period, temperature, aeration, precautions.

WRITE PESTS—DOW

Hydrocyanic Acid Poisoning—Skin Absorption

Bulletin discusses some pertinent safety suggestions with respect to avoidance of hydrocyanic acid poisoning through skin absorption.

WRITE PESTS A-C-74

BIRD REPELLENT

Circular describes product which manufacturer claims will serve as an effective repellent against pigeons, starlings, bats, dogs, cats, rats, mice, woodchucks, moles as well as crawling and flying insects that prey upon plantings and seedlings.

WRITE PESTS—PX

THE ACTIVATING EFFORT OF PYRETHRUM UPON THE GERMAN COCKROACH

Research material prepared by John M. Hutzel, of the Ohio State University, Columbus, Ohio in cooperation with the Kenya Pyrethrum Extension Service, Inc., N. Y. Supervised by Professor F. L. Campbell.

WRITE PESTS—PYRETHRUM.

NEW ANT TRAP

Manufacturer claims many new features such as no turning or twisting necessary; four openings; larger trap; contents ½ greater than any other competitive brand.

WRITE FOR YOUR FREE SAMPLE OF ANT TRAP TO NOTT, c/o PESTS.

PRESERVATION OF LUMBER, POLES, POSTS, PLYWOOD WITH PENTACHLORPHENOL

This bulletin gives a brief summary of the properties, use to date, and recommendations for the preservative treatment of lumber, poles, posts, and other forest products with Permatox A. This product, it is stated, has shown outstanding promise as an effec-

tive and permanent oil preservative for many wood products. Set forth briefly also, are recommendations for the effective preservative treatment of lumber, poles, posts, and other forest products with Permatox A, based upon experience to date.
WRITE PESTS—BULLETIN 43-A.

FUMIGATION SAFETY RULE

Bulletin discusses importance of personal inspection of entire premises immediately before releasing gas, and offers some constructive suggestions with respect thereto.
WRITE PESTS—A C 81.

CALCIUM CYANIDE FOR RAT CONTROL

36-page booklet contains excerpts from official publications and reports of health officers throughout the world regarding use of calcilum cyanide in the control of rats. The widely differing conditions surrounding infestations, and the specific types of control for each, which are described, will serve as suggestions to health officers and others in solving similar problems.
WRITE PESTS.

FUMIGATION SAFETY RULES

Bulletin discusses fumigation safety rules with respect to mattresses, pillows, bedding, clothing and bedroom rugs, etc.
WRITE PESTS—AC No. 79.

FUMIGATION SAFETY RULE

A review of fumigation accidents of record for 1943 shows that oversight or disregard of rule to lock all doors and accessible windows, failure to place warning signs thereon and failure to post guard during fumigation account for approximately 20% of the accidents. Bulletin discusses ways and means to eliminate accidents of this nature.
WRITE PESTS—AC No. 80.

DOG-CHECK

Circular describes remedy which manufacturer claims is effective for breaking dogs and cats of their undesirable habits, that rain will not wash it off, odor will last for three weeks and can be sprayed directly on new growth. Free sample if you write on your letterhead.
WRITE PESTS—NOTT CO.

Fumigation manual. 76-page manual describes safe handling and working with "Cyanegg" and on fumigation procedure and insect control. Illustrated.
WRITE PESTS—DuPONT .

INSECT TRAPS

Bulletins describe traps for ants and roaches, with suggestions for their use.
WRITE PESTS—SOILICIDE.

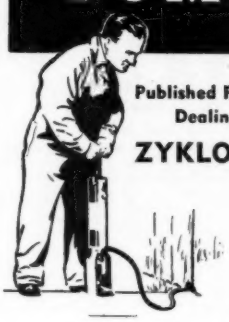
The Texas Gulf Sulphur Co. has recently published a revised copy of The Use of SULPHUR in the CONTROL of TRUCK CROP and CANE FRUIT INSECTS and DISEASES. Any desiring a copy of this booklet which is for free distribution, can obtain it by writing to The Texas GULF SULPHUR Co., Second National Bank Bldg., Houston 2, Texas.

GAS MASKS—RAT CONTROL PROGRAMS

Bulletin offers some pertinent suggestions regarding gas masks and how to keep them in perfect condition. It also discusses rat control programs and what the PCO can do to further them.
WRITE PESTS—AC82.

Aim high. Strive for an ideal. Live it. Dream it. Pray for it. Wish for it. Long for it. Fight for it. And as sure as there are stars in Heaven, you'll attain it.

FUMIGATION NEWS



Published For The Information Of The Pest Control Industry Dealing With Fumigation Involving The Use Of

ZYKLON DISCOIDS AND CYANOGAS

AMERICAN CYANAMID & CHEMICAL CORPORATION
Insecticide Department
32-E Rockefeller Plaza, New York 20, N. Y.
Branch Offices—625 Dwight Bldg., Kansas City 6, Mo.
2203 Ferry St. South, Seattle 4, Wash.—Azusa, Cal.

EFFECT OF HCN ON FOODSTUFFS

A very natural question often comes up as to the effect of ZYKLON DISCOIDS (the HCN fumigant) on foodstuffs. The best answer to such a query is that through exhaustive research, it has been found that hydrocyanic acid may be used to fumigate the widest variety of food products without impairing their color, texture or flavor in any way.

Hydrocyanic acid does not combine chemically with foodstuffs and is not fixed permanently in the products under treatment. Certain precautions should be observed, however, when fumigating commodities carrying a high moisture or oil content. For example, in the fumigation of domestic dwellings, it is necessary to remove all milk, butter and liquid foods, such as jams and preserves, unless contained in sealed containers. When commodities carrying a high moisture or oil content are fumigated directly as in a fumigation chamber, the desorption of HCN is slowed down, and the aeration period should be extended before releasing them for public consumption. Fresh fruits and vegetables should never be fumigated with the dosages of HCN used for dry food commodities.

TEST FOR THE PRESENCE OF HCN

More and more Pest Control Operators are now using methyl orange test papers as standard procedure. These are small strips of paper which immediately turn pink or red in the presence of hydrocyanic acid. They are placed between mattresses, pillows and bedding to indicate the presence or absence of HCN.

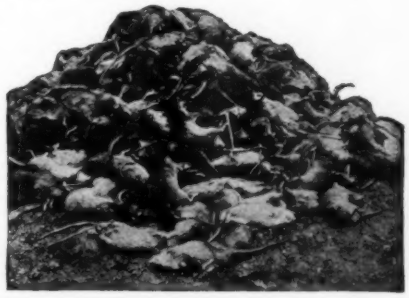
Methyl Orange Test Papers are available from this company in convenient bottles, bearing a combination label and color chart at 50c per bottle containing approximately 75 papers.

PRE-COOLING ZYKLON DISCOIDS

During the hot weather the Pest Control Operator should keep in mind that when he has a fairly large quantity of ZYKLON DISCOIDS to be used at one time, say 50 lbs. or more, they should be pre-cooled several hours before fumigation. This is readily accomplished by the use of dry ice. The procedure is to remove the tops of the shipping cases and also to remove the fibre cap from the Discoid cans, both the top and bottom layers. Then, before replacing the upper layer of cans, cover the lower layer with dry ice. Finally, cover the entire case with a heavy canvas or tarpaulin in order to "keep the cold in."

CITY DUMPS EASILY CLEANED OF RATS WITH CYANOGAS

An outstanding example of large-scale rodent eradication recently occurred at a Jersey City dump. A few highlights would be of interest.



A rat-infested Jersey City dump was entirely cleared of rodents with CYANOGAS.

Typical of all rat infestations, the city dump was the source and foci of infestation, as well as a rat paradise. This area had been used as a dumping ground for many years—a perfect harborage from which rats could carry on their depredations and spread their infectious diseases.

For a control material in combatting this infestation CYANOGAS A-DUST was selected. An area was sectioned off and CYANOGAS was dusted into the burrows by using a CYANOGAS Foot Pump. Pressure equipment makes it possible for the gas to be diffused deeply and effectively into the tortuous, winding burrows. Those escaping from other exits of the burrow system in many cases dropped dead in their tracks a few feet from the burrows since they had breathed a quantity of HCN.

The following morning very few new burrows were found, and those which did appear were again treated with CYANOGAS. When the dump had been completely treated the area was filled in and bulldozed, and today this area is thoroughly sanitary, clean and entirely cleared of rodents.

For positive and economical rat control there is no equal to CYANOGAS. In sectioning off any particular dump area approximately 40 to 50 burrows can be treated with maximum results with only one pound of CYANOGAS. Its record of performance —millions of dead rats—bears vivid testimoney to its effectiveness.

--BOOKS--

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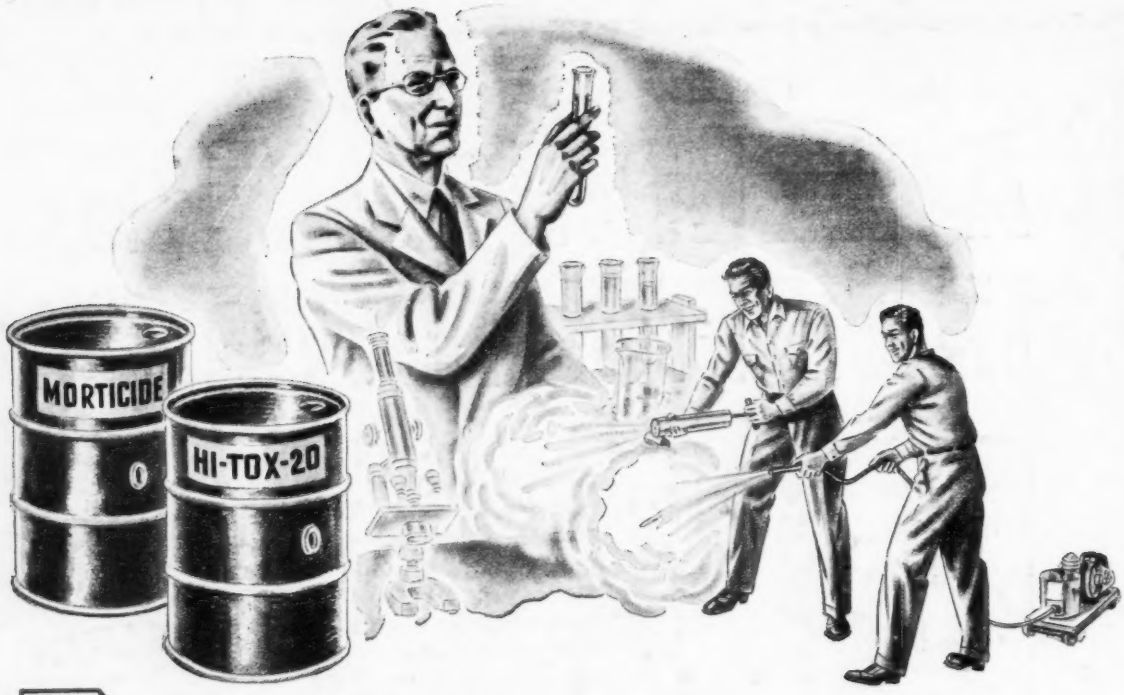

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